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STRAIN INVESTIGATION RELATIVE TO GRASSES AND CLOVERS.

(Continued from July.)

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(2) Cocksfoot (Dactylis glomerata).

COCKSFOOT occupies a place among pasture grasses second in importance to perennial rye-grass. We hold that the ideal in grasslands is a mixed sward with perennial rye-grass as the dominant species. Cocksfoot ranks as an associate species to perennial rye-grass, and when kept as such by judicious management the pasture as a whole functions at its best as a grazing and milk-producing pasture. Dominant cocksfoot pastures are excellent, of course, but an increasing dominance of cocksfoot must be regarded as a falling away from the possible ideal.

In the earlier days of grassland farming in New Zealand cocksfoot was acclaimed "king of the grasses." In those days, when rough feed characterized our grasslands—associated with cocksfoot-seed production, then so common over many areas that to-day never see the reaping-hook, when milk production and fat-lamb production ranked second to beef, hides, and wool, and when the call for higher production per acre was not so insistent, then did cocksfoot rear above all other species as a veritable king among them. Conditions on the farm have since changed. Our ideas in regard to herbage utilization and what constitutes good pasture-management have been modified. The production of milk and fat lambs calls for young grass—for a mixed pasture of grass and clover, shorter and sweeter, more palatable, and more perfectly balanced as a food ration. This has tended to create a condition prejudicial to the maximum development of cocksfoot, and to-day it must be placed second to perennial rye-grass.

Cocksfoot is essentially a top grass—a shade-endurer and a shade-demander. Its life-form is essentially a tussock. In the making of a

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sward our aim is to suppress the tussock form and make of cocksfoot a turf grass—which, we add, is cocksfoot's undoing. The suppression of the natural growth-form mitigates against the optimum development of this grass, and for this reason the normal commercial type of cocksfoot never shows to the same advantage in what is considered a well-grazed, well-utilized sward as it does where rank growth predominates. Rough growth provides the all-essential shade to the crown, and protects from sun and wind the basal portions of the shoot from whence new roots arise. This may at first sight appear an insignificant detail, but upon the production of these new roots in every growing-season depends the subsequent growth of the plant. In short pastures, and particularly under close and continuous grazing, this new root-system does not develop to anything like the same extent as in the case of rank growth where the crown is shaded and where the base of each shoot is wrapped by dead leaf-bases that hold the moisture and thus set up good rooting-conditions. Where the wind and the sun get right to the crown the bases of the shoots dry rapidly, new roots cannot form, and before long the old roots cease to function and die, with the result that these cocksfoot-plants lose their grip of the soil and are readily pulled out or knocked out by the grazing and treading of animals. The closely grazed open turf is much more fatal to cocksfoot than is the dense turf where rye-grass, white-clover, and crested dogstail abound. These associate species help to shade the crown of the cocksfoot-plant.

We venture to say that cocksfoot of all grasses calls for the greatest skill in the adjustment of the habitat and in the selection of type so that optimum value from this species may be secured by the farmer whose main object is the production of milk or mutton. On grazing-runs, and for those other areas where rough winter feed cured *in situ* is an essential part of farming, cocksfoot is extremely valuable. Dairy cows turned on to the hills among rank cocksfoot winter well on it, and for the ordinary cattle of the run there is perhaps nothing better than a rough hillside of cocksfoot for the winter. On the dairy farm where dry autumns are often experienced and where rye-grass has not a long summer-growth period (one great weakness of rye-grass) cocksfoot fills that summer and autumn breach better than any other species, with the exception of paspalum in Auckland Province. Because of this period cocksfoot is necessary in the mixture, but at the same time it must be remembered that one of the finer points in grassland farming is to learn how to so manage the pasture as to retain cocksfoot but yet keep it in control, so that perennial rye-grass and white clover are dominant for as many months in the year as possible.

In soil-fertility requirement cocksfoot occupies a position in the scale just below rye-grass. Hence on those soils incapable of supporting rye-grass, and during those low-fertility periods of the year caused by drought conditions, cocksfoot fills an important and an essential place.

STRAIN IN RELATION TO COCKSFOOT.

From the foregoing it will be seen that cocksfoot is essential to the grasslands of New Zealand as a whole, and the question that strain work opens up is whether the best type of cocksfoot that can be secured is being employed for the more intensive grass-farming. For rough

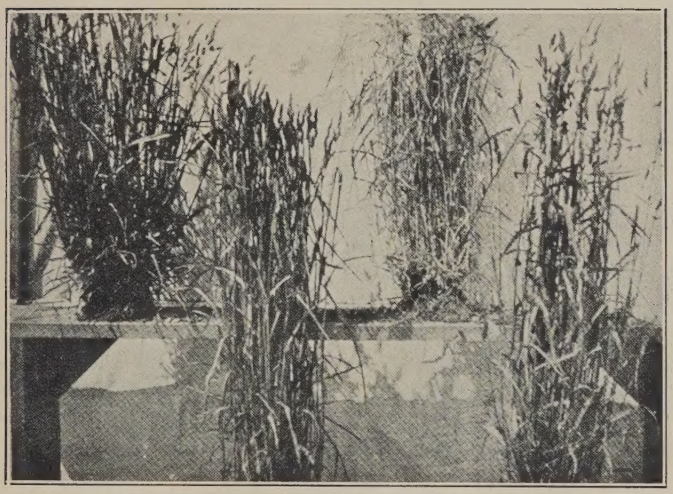

FIG. 1. DANISH COCKSFOOT: SINGLE PLANTS SHOWING STALKY, ERECT TYPE.
Note earliness of flowering. Compare Figs. 2 and 3 taken on same date.

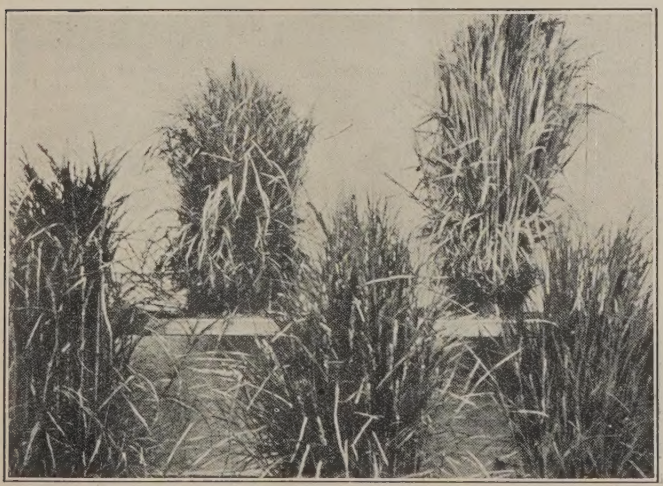

FIG. 2. INTERMEDIATE TYPE OF COCKSFOOT: SINGLE PLANTS SHOWING DENSE LEAFY FORM.
This type is commonly found in Akaroa cocksfoot. Compare Fig. 4.
[*Photos after R. G. Stapledon, Journal of Ecology.*

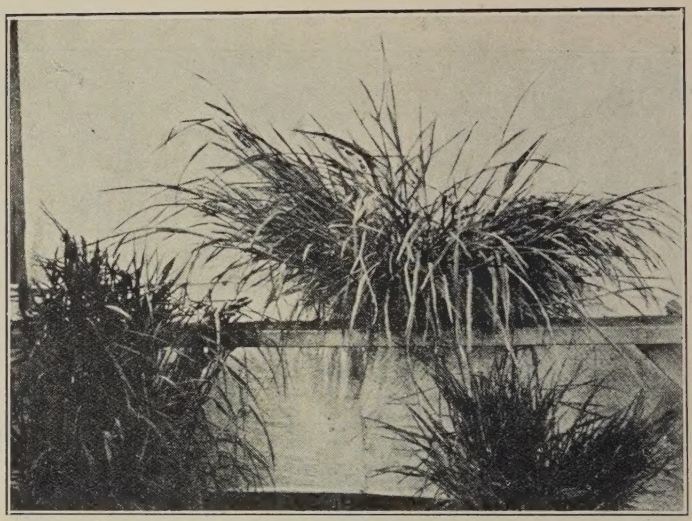

FIG. 3. DENSE PASTURE COCKSFOOT: SINGLE PLANTS FROM SELECTIONS AT ABERYSTWYTH OUT OF OLD-ESTABLISHED PASTURES.

Note extreme density of leafage, low proportion of stalk, and lateness to flower. Compare Fig. 1.

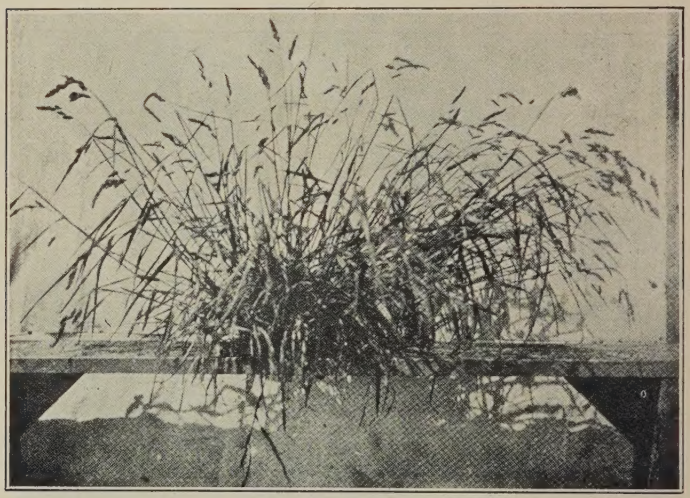

FIG. 4. UNDESIRABLE TYPE OF COCKSFOOT MET WITH IN SAMPLE OF NEW ZEALAND ORIGIN.

The aim of the plant-breeder is to cull out these undesirable types and to select only the best. Compare Fig. 2.

[*Photos after R. G. Stapledon, Journal of Ecology.*

rank feed the question of strain in cocksfoot is probably not important, but we are of the opinion that rotational grazing with full utilization and the more general exploitation of young grass have come to stay. These practices are essentially linked up with maximum production from grassland.

This better utilization, this tendency to suppress seed and stem production, to feed pastures more adequately by regular and systematic manuring, and to extend the profitable life of pastures, calls for an entirely different type of cocksfoot to that which thrives under rough and rank growth conditions. What is required for the grazed pastures of to-day is a dense, multitillered, low-set crowned, leafy rather than stemmy type—one that can thrive, blend in with, and contribute in season its quota of feed as an associate plant in the ideal rye-grass and white-clover pasture. The master factor, however, is persistency and the ability to perennially reproduce by vegetative tillering rather than by annual reseeding. Ability to withstand heavy punishment, such as by grazing and treading, is also a factor of importance. In this respect cocksfoot as a species does not equal perennial rye-grass, but there are types of cocksfoot which show the ability to withstand heavy intermittent grazing while still retaining their place in the pasture.

These latter forms of cocksfoot are in extreme cases very shy seeders. Many forms produce abundant seed, but yet are characteristically persistent, long-lived, and leafy rather than stemmy. These leafy persistent forms help to widen the habitat range of the species, particularly in the direction required. Under a system of intermittent grazing they are able to outyield the short-lived types on all soil-conditions. On really good soils they may hold indefinitely in association with rye-grass, crested dogstail, and white clover, and under properly controlled grazing they have a place in such swards, augmenting the autumnal growth in particular, and under good management will not compete adversely with their associate species. On the less fertile soil-types they can persist for a number of years, will tide over conditions of temporary starvation, and with a subsequent increase in fertility are able to regain their proper position in those swards.

Strain differences in cocksfoot of different origin were noted many years ago by agricultural workers. The late Professor Gilchrist, in England, for example, showed that New Zealand cocksfoot as a type was more lasting than the Danish strain. More recently Professor Stapledon* has made a complete systematic survey of this species, and while confirming the work of Gilchrist, so far as that went, has further shown that cocksfoot can be classified into a number of growth-forms or ecotypes (Figs. 1–4). All commercial lines of cocksfoot can be placed in one or other of several groups. Danish, French, and American cocksfoot, for example, are generally of one type, and are characteristically short-lived forms of the species. These are often heavy seed-producers, and always bear a high proportion of stalk and a correspondingly low proportion of leafage. As pasture plants these types fall short of our ideal. New Zealand cocksfoot, on the other hand, is a different type; it is more persistent, more dense at the crown, has the crown well down to the surface soil, is multitillered, producing a high proportion of leafage,

* STAPLEDON, R. G., Cocksfoot-grass (*Dactylis glomerata*). Ecotypes in Relation to the Biotic Factor. Journ. Ecol. 16, 1928.

FIG. 5. DANISH COCKSFOOT, SHOWING COARSENESS OF LEAF AND GENERAL APPEARANCE IN MOWN SWARD.

The shoots tended to remain prostrate all winter; the crowns are few-tillered and tend to be raised.

FIG. 6. NEW ZEALAND COCKSFOOT SHOWING FINER LEAF AND MORE TILLERS TO THE CROWN, TENDING TO BE DEEPER SET THAN THE DANISH (FIG. 5).

[Photos by E. Bruce Levy.

and as a type is more suitable for grazing than cocksfoot from other commercial sources. Akaroa (N.Z.) cocksfoot must, however, be looked upon as a mixture of widely differing strains. True, the bulk of these are good pasture strains, but there are included also some types which are altogether less desirable for use in permanent pasture mixtures. There is room, therefore, for systematic plant-selection in cocksfoot, as was shown in the case of rye-grass in the preceding article of this series.

STRAIN TRIALS AT THE PLANT RESEARCH STATION.

One hundred and nineteen lines of cocksfoot are being grown on the Plant Research Station area at Palmerston North. These have been largely drawn from commercial sources, and a few are of special pedigree lines from Great Britain. The outstanding feature of this trial at the present time is the marked difference between Danish cocksfoot and average New Zealand lines (Figs. 5–7). These plots stand out quite distinctly, and the relation between the stands of New Zealand cocksfoot on the one hand and the Danish type on the other is the difference respectively between success and failure so far as a grazing-pasture is concerned. New Zealand cocksfoot grew well right through last winter (Fig. 8), and produced a fair amount of leafage, typically light green but quite a healthy colour. There was very little sign of leaf-burn* except on the Danish plots, where a considerable proportion of the leafage browned off. The winter growth-form and colour of the Danish plots were very characteristic, being glaucous green in colour, few-tillered, and open at the crown; the tillers are coarse and tend to lie flat on the ground, this latter character being partly due to the thinness of the plots in comparison with those of the denser Akaroa type. Virtually no growth was made by the Danish cocksfoot from the end of April to the beginning of August (Fig. 8). Growth commenced early in August, but this has been mainly concerned in the production of stem and flowering-shoots. By the end of October quite an appreciable number of flower-heads had appeared (Fig. 9). The New Zealand type at that time was still showing high leaf-production, with scarcely any tendency to run to seed (Fig. 10). In mid-November portion of each plot was cut at the hay stage. The aftermath showing on 1st December further emphasized the value of the Akaroa type as against the Danish; Akaroa was recovering well, but recovery of the Danish was poor. There is absolutely no doubt on the evidence of the trials concerned of the inferiority of Danish cocksfoot for New Zealand conditions. The trials are in full support of evidence collected elsewhere in New Zealand, substantiating the work of Hilgendorf at Canterbury Agricultural College, and are supported by similar trials conducted in Great Britain.

With a view of making a rapid survey of cocksfoot used in New Zealand, and to find out as soon as possible the relative life of each type under pasture conditions, a section of each plot at the Plant Research Station area is being cut back with a lawn-mower once every week. This treatment has only been in operation for about six months,

* Winter burn or browning in pasture plants is apparently a physiological reaction assumed by the plant to tide over period of adversity. The general indications are that the more hardy strains within any species are the least winter-burned. (See Stapledon and Davies, Journ. Min. Agric. 32, 1926.)

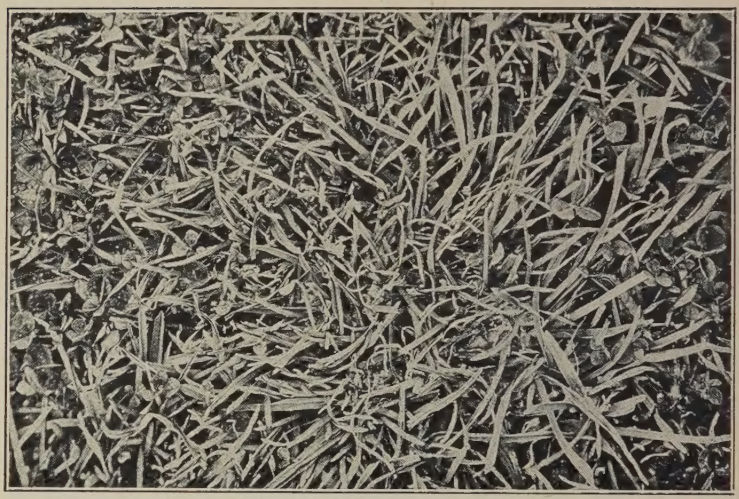

FIG. 7. COCKSFOOT FROM ABERYSTWYTH (Bc. 1629) EX LEICESTER OLD PASTURE, GROWING ALONGSIDE DANISH AND AKAROA (FIGS. 5 AND 6).

Type selected for fineness of leaf, multitillering, low-set crown, and persistency.

[*Photo by W. Davies.*

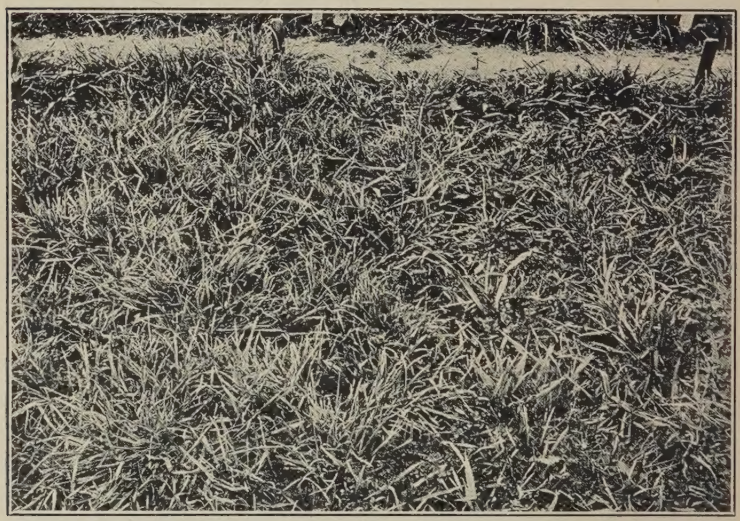

FIG. 8. AKAROA (LEFT) AND DANISH COCKSFOOT (RIGHT) COMPARED FOR WINTER GROWTH.

The Akaroa cocksfoot grew moderately well all winter, but Danish was winter-dormant from April to August. Compare Figs. 9 and 10.

[*Photo by E. Bruce Levy.*

but the plots are already showing differences in reaction. The short-lived Danish types are less productive under this treatment, while the multitillered Akaroa type is apparently thickening up and is producing a more or less dense sward of cocksfoot associated with an abundance of volunteer white clover. It will be some time before statistical results can be obtained to show the differences in holding-power between cocksfoot from various New Zealand sources. At present there is little apparent difference in type as between Akaroa, Plains, Wairarapa, Hawke's Bay, or Southland cocksfoot. All are outstandingly better than Danish cocksfoot. New Zealand cocksfoot, however, often contains a fair proportion of rye-grass as an impurity, and from our trials this seems to be specially true of certain lines from the Canterbury Plains, and occasionally also lines from other sources. N. R. Foy in a recent report (this *Journal* for May, 1929) has made further reference to the incidence of rye-grass in samples of New Zealand cocksfoot tested at the official seed-testing station.

Having regard to the fact that trials both in New Zealand and in Great Britain have conclusively shown that this country already produces in commercial quantities a good pasture-type of cocksfoot, it is of great importance that the type shall not be lost until such time as approved strains of a still superior type become available in quantity. There is a need for co-operation between growers, merchants, and consumers to ensure and to increase supplies of approved cocksfoot types at least up to the point at which the whole of the New Zealand requirements would be filled. Further than this, there are immense possibilities for building up an extensive export trade, a subject that will be dealt with more fully in a subsequent article of this series. For long lea conditions and for permanent pasture we firmly believe, having due regard to the evidence before us, that not an ounce of the short-lived Danish cocksfoot should be sown either in Britain or in New Zealand. There is need for action to ensure that adequate supplies of cocksfoot-seed of the right type are forthcoming to fulfil the requirements of both countries.

New Zealand is annually importing a large quantity of cocksfoot-seed, nearly all of this being the short-lived, non-pasture type. In 1928 rather over 50,000 lb. of New Zealand cocksfoot was exported, this amount being negligible in comparison with the cocksfoot importations. New Zealand apparently uses about 3,000,000 lb. of cocksfoot-seed each year, and of this amount some 62 per cent. is home-grown and about 38 per cent. of the imported varieties. According to official statistics, for the seven years 1921–28 the average amount of cocksfoot-seed produced in New Zealand was about 1,885,000 lb annually, and for the four years 1925–28 inclusive about 1,130,000 lb. of cocksfoot was imported annually into New Zealand. For a country with almost unlimited scope for seed-production, and already producing a good type of pasture cocksfoot, the consumption of imported seed of the non-pasture type is altogether excessive. This country essentially requires persistent, leafy, and high-yielding strains designed to withstand heavy grazing of a perennial nature. Danish cocksfoot does not fulfil this purpose, and is therefore an undesirable form. Britain is similarly using Danish and other short-lived strains of cocksfoot, only an insignificant amount of the New Zealand type being

FIG. 9. DANISH COCKSFOOT AT END OF OCTOBER, SHOWING UPRIGHT STEMMY NATURE AND TENDENCY TO RUN TO SEED.

Compare Fig. 10.

FIG. 10. NEW ZEALAND COCKSFOOT TYPE AT END OF OCTOBER, SHOWING LEAFY AND MULTITILLERED CROWN, AND MUCH LESS TENDENCY TO RUN TO SEED THAN DANISH (FIG. 9).

[*Photos by E. Bruce Levy.*

imported. A few of the leading English seed firms offer more or less good pasture strains, but these, in company with New Zealand cocksfoot, are retailed at a price considerably in excess of that ruling for Danish seed. The high relative cost of seed, coupled with a lack of real knowledge regarding the evaluation and significance of strain, tend to inhibit the wider use and extended sales of the pasture types.

If New Zealand is to compete successfully in world markets she will have to pay greater regard not only to strain or type but also to the improvement of seed-production methods. Cocksfoot-seed must be regarded as a definite crop and treated accordingly. Growers must know how to manure and how best to manage the cocksfoot-seed paddocks, having in mind increased yields of high-germinating seed produced at the lowest possible cost. Denmark has been growing cocksfoot for years, and has worked seed-production up to a fine art. Little regard, however, has been paid to the production of pasture strains. For the conditions of small holdings and of short rotations as commonly practised in Denmark the rapid-growing short-lived types may be excellent, but for countries where long-term rotations are practised this type is inferior.

New Zealand would do well to learn all she can of the seed-production methods of other countries, but while improvement in method is being effected the significance of strain must not be lost sight of. It is essential that the type be retained. There appears to be a world shortage of seed-supplies in regard to superior pasture strains of our commoner herbage plants, and we strongly submit that New Zealand should take steps to fill this need. There is no country in the world better suited or in a stronger position at the present time to bid for this market than is New Zealand.

BLENDING OF NEW ZEALAND BUTTER IN BRITAIN.

REPORTING on his recent official visit to Britain, Mr. W. M. Singleton, Director of the Dairy Division, remarks as follows on the above subject:—

Blended butter appears to be used by a considerable proportion of the consumers in the United Kingdom. So far as my experience went most of the blending appeared to be done in the London, Devonshire, and Bristol districts. It is known that some of New Zealand whey butter finds an outlet in blending with Argentine, Australian, Siberian, and Irish butters, and in some cases with New Zealand "Finest" grade creamery butter. I have been advised that in view of the fact that New Zealand finest creamery has to be purchased at a price which is above that of other butters used for blending, only sufficient of our best butters is used to give the necessary quality to the blended article. Estimates of the proportion of our total shipment which is used for blending run from 10 to 20 per cent. So far as I could learn the probability is that not more than 10 to 15 per cent. is used in this manner. While blenders are said to be keen to obtain whey butters for blending purposes it is also known that they are extremely anxious to get high-quality creamery butter from this Dominion for the purpose of introducing our creamery butter into the blended article. There appeared to be a good deal of information to the effect that the advertising of New Zealand and other creamery butters was causing the replacement of blended butters, and as a result blending was thought to be on the decrease. I was advised by retailers that the sale of butter in cartons was becoming more popular, and this is another factor which seems to be working in the direction of enabling unblended butters to replace the blended article.

DISEASES OF DAIRY COWS.

(Continued.)

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II. CONTAGIOUS BOVINE ABORTION—*concluded.*

(3) ELIMINATION MEASURES IN AN INFECTED HERD AND THE BUILDING-UP OF AN ABORTION-FREE HERD.

THE cleaning-up of a herd of dairy cows already affected with *Bacillus abortus* is in the first place a long affair, but it can be done successfully if the stringent precautions are carefully carried out by all associated with the management of the herd. The method of procedure is not the same in every case, and the details must be very carefully thought out, depending, of course, upon the importance of the herd—for example, its breeding-value; the economic value of the animals—that is, pedigreed, tuberculin-tested, or recorded; the facilities for handling the groups; and, finally, the extent of the infection. The procedure must of necessity be based on the result of the initial agglutination test, followed by segregation of reactors and non-reactors, or the isolation of the non-infected and the disposal of the infected. Vaccination of the latter, or even of the whole herd, may under certain circumstances be permitted. Every animal of breeding age in the herd must be tested, and only when the results are known can appropriate plans be formulated for the necessary control. This would naturally depend upon the number of reactors to the test.

The Agglutination or Blood Test.—The efficacy of the agglutination test in demonstrating the extent of the infection in a herd has been already discussed, but it is considered necessary that such test be repeated at suitable intervals in order to detect animals in the incubation stage or in a period of latent infection. Three tests are to be advised, carried out at four to six weeks' intervals, one preferably two or three weeks immediately following calving. This will eliminate all infected animals, but as in all biological tests doubtful cases must be met with, these can be grouped together as "suspects," and may be placed near the non-reactors till the next test. In the event of these suspects calving or aborting during this period, strict isolation, disinfection, and cleansing will be necessary. New purchases or young stock bred on the farm will be dealt with as in the case of the clean herd which was being protected from infection.

Procedure.—The method of elimination of contagious abortion was first formulated by Sir John M'Fadyean, who suggested and put into operation a scheme based on the establishment of herds free from infection on the results of the agglutination test. The question of what is to be done with the reactors is a matter to be decided on, and accordingly the percentage of same in the herd is usually the deciding factor. Segregation of the reactors and non-reactors will necessitate two units or groups, whereas disposal of the former or vaccination of the whole herd calls for no additional financial outlay or even change in routine. Where two groups are decided on the infected unit may or may not be vaccinated.

After the results of the general agglutination tests are known, the policy can be settled and the mode of action decided on. In long-standing infection the percentage of reactors is generally very high, and in consequence of the small number of healthy animals it is practically hopeless to consider dividing the herd and eliminating the reactors, owing to the heavy cost and large amount of labour and time involved. It would be advised in such a case that the best policy would be to vaccinate the whole herd with living cultures as discussed later. It is possible, however, to succeed in another way, and in fact in a relatively easy manner, by making the young stock bred on the farm the starting-point for the building-up of an abortion-free herd. This, of course, presupposes facilities for the maintenance of two units or groups.

On the contrary, when the infection is recent and the percentage of reactors is small, dividing the herd is advised, and the reactors are eliminated as soon as possible. It is worth remembering that such cows can be isolated on remote pastures as nurse-cows, and thus cause no additional trouble or real loss. Otherwise, sale for immediate slaughter or as additions to already infected herds are the only rational means of disposal.

When the infected are about equal to the non-infected, other things being considered—such as the economic value of the herd —dividing of the herd may be carried out. The non-infected group is removed as far as possible from the others, and isolated as the clean herd, and the infected is housed or depastured together as the infected herd, in separate paddocks, and buildings where such are provided, with its own utensils and, if possible, own attendants. Vaccination with living cultures of the whole of the infected group may with advantage be carried out. The milk is pasteurized before use, and the calves reared under suitable management to be added later to the clean herd.

It is only when the percentage of reactors is small—say, 20 per cent. at the most—and the owner can find it convenient to immediately dispose of these, that one set of paddocks, &c., will suffice for elimination.

The Clean or Non-infected Group.—Seeing that, as recommended above, all suspects are housed or depastured near the non-infected cows, they must be very carefully watched, and, in fact, inspected individually each day. This need not entail any additional labour, as their number will be small, but it will minimize the risk of an occasional abortion of an infectious nature. This examination should be made the rule in all herds where the risk of infection still remains in the vicinity, and especially so where two herds are being maintained on one farm as outlined above. Agglutination tests of individual animals must be carried out from two to three weeks after each calving, before newly calved cows are returned to the clean herd from the calving-paddocks. Should a calving or abortion take place in the common herd or at pasture the place and general surroundings must be very carefully disinfected. A special tested bull must be kept solely for use in the clean herd, and he must have passed the same three tests as the cows in the group. The elimination of infected animals from the herd necessitates further additions, either by the purchase of cows just at calving, or by bringing in the offspring from both groups, or even young stock reared in infected herds, but since

service kept isolated from the chance of infection. All such subjects must be submitted to the usual agglutination tests on admission.

In addition to the foregoing, the measures suggested for the protection of a herd found entirely free from contagious abortion at the first test must be carried into operation.

The Infected Herd or Group.—The infected herd comprises all the reactors to the agglutination tests, and the policy here adopted is to dispose of these as soon as possible, if few in number, even at a sacrifice; but, carefully managed, such a herd need not result in any considerable financial loss. The calves can be used for additions to the clean herd, for more than 90 per cent. of calves born of infected dams will react negatively to the blood test at from four to six months, depending, of course, upon the facilities for isolation immediately following the milk-drinking period. Calves recently segregated from the infected herd must be kept apart from heifers near the breeding-age, and at the same time must be removed from contact with the cows in the clean herd for an extended period following weaning from infected milk, in order to minimize the risk of carrying infection.

From what has been said it will be evident that heifers can be successfully reared from the infected herd, and accordingly used for adding to the clean herd or building up a new herd altogether. Provision will have to be made for a separate bull for the infected herd. Within the infected herd it is obvious that abortions will continue to occur until all the subjects therein have developed sufficient so-called immunity to enable them to carry their offspring to the normal time. In order to hasten such a desirable state the use of living cultures of *B. abortus* has been advocated.

The disposal of the animals in the infected herd should be a matter for the owner's most careful consideration, since sale without disclosure cannot be too strongly condemned, but even warrants State intervention, as already mentioned. The periodic removal of a few of these reactors for slaughter will suffice in the long-run to deplete the herd, and even dispose of it altogether. The real reason for this advice is perhaps not evident, but it must be obvious that breeding-deficiencies warrant such disposal—for example, calving abnormalities, metritis, retained membranes, and sterility even. In certain herds the chronic reactor remains a satisfactory milk-producer and breeder, but such herds are in the minority. Again, it has been suggested that reactors might with advantage be sold to neighbouring farmers whose herds consist largely of reactors to the blood test. Only those reactors which will conceive and breed normally can be disposed of in this way, for these animals are certainly worth more to place in an already badly infected herd than would be the non-reactors. The latter would immediately contract infection, with the usual disastrous results. The sanitary precautions necessary in order to prevent infection from being carried to other parts of the farm, and to safeguard neighbouring herds, consist of rigid disinfection at all times, and should include burning or burying in quicklime all aborted fœtuses and fœtal membranes.

The question of the sale of reactors must not be confused with the sale of cows which abort, for the sale of the latter can never be successful in eliminating the disease from the herd, since it can be appreciated that many other cows harbouring infection will calve to

time a viable calf, and yet act as spreaders of the disease within the herd. At the same time, the cow which has aborted once may possibly calve normally at the next gestation, but not necessarily so.

Having thus outlined the means whereby a clean herd can be protected and an infected herd cleaned up, it is obvious that the maintenance of an abortion-free herd is possible. Unless, however, the farmer is prepared and his workers are willing to carry out all instructions necessary, and to continue to do so, veterinary intervention is not only useless but a waste of both time and money. Towards this end, however, a demand must arise or be created for milk from abortion-free cows, either through State action or by the dairy-factories, or even by the public; and at the same time the farmer must learn to realize the losses consequent upon repeated abortions in his herd. With regard to the latter, in addition to the loss of the calf, there is the loss in production during the lactation period which immediately follows. This has been estimated at one-third of the normal yield, and therefore in the third year of a serious outbreak, when the abortions amount to possibly 50 per cent. of the herd, the loss to the farmer would be one-sixth of his total income for the year. In addition, also, there is to be reckoned the other consequences—namely, metritis, arthritis, sterility, &c.—and finally the upsetting of the breeding calendar, where seasonal yields are so necessary.

Treatment of Contagious Bovine Abortion.

The insiduous nature of the infection and the chronic manifestation of the disease naturally permit one to assume that treatment would of necessity be difficult, and this has proved to be the case. It has been suggested that mineral deficiencies are responsible for the lowering of the natural resistance, and the theory of lack of calcium, iodine, &c., in the metabolic processes has its adherents; accordingly treatment embodying the use of such minerals in different forms has been tried both in prophylaxis and cure. Against this may be mentioned also the increase in virulence of different strains of *B. abortus* as perhaps an important factor in the infectivity of the organism. The true explanation of the spread of the disease is difficult to ascertain with certainty, but it can be definitely stated that no line of medicinal treatment yet tried has given any hope of success in combating the infection in the herd.

The infection in the case of many individuals is frequently followed by complete recovery when the organism is eliminated from the body, and the animal is assumed to have acquired a certain degree of immunity. Again, some cows seem to exhibit a natural immunity, and this is particularly seen in heifers which as calves, or even as yearlings, have been exposed to infection and subsequently isolated before being brought in for service. This would appear to account for the lower incidence of abortions amongst first calvers in infected herds. It has been considered by the French workers Vallée and Rinjard, of the National Research Laboratory, Alfort, that if an immunity is acquired it is an active immunity—or perhaps better an infection immunity—which persists only so long as the organisms remain localized in the animal-body—for instance, in the udder, where it has been shown that no clinical manifestations can be observed yet *B. abortus* is being excreted in the milk. This is the interpretation of the immunity

acquired by the use of B.C.G. vaccine against tuberculosis. The above-mentioned workers prefer, therefore, to assume that a great many of the animals in the herd acquire a "tolerance" to the infection, with the result that in subsequent pregnancies they carry the calf to the normal time, but still act as spreaders of infection, and at the same time become chronic reactors.

This interpretation of the so-called immunity would appear to offer a suitable means whereby a herd could be protected from infection, when suitable immunization methods would prove of service in preventing abortions, thus saving the calves by hastening the production of a herd immunity or "tolerance."

Sera, culture filtrates, and aggressins have been tried extensively in America, but have so far failed to justify more than a continued study of such products. Bacterins or dead cultures of *B. abortus* killed by heat, formalin, or chloroform, have been employed in many countries, but so far they have proved of no value or only doubtful success in prevention or treatment. Living vaccines or cultures of unattenuated strains of *B. abortus* have been experimented with and even used extensively in the field in many European countries, and perhaps more so than available laboratory findings concerning their usefulness really warrant.

Treatment must therefore be on preventive lines, and when the disease has made its appearance the procedure to be adopted must be carefully outlined according to the extent of infection as assessed by the blood test, the individual herd requirements, and the facilities for handling which may be available.

CONSIDERATIONS ON VACCINATION.

In concluding this interpretation of the problem it may be of interest to deal with the use of living and dead vaccines or cultures of both virulent and non-virulent strains of *B. abortus*. In doing so the writer will outline the procedure being adopted in those countries visited by him. In most countries where protective inoculation has been made the subject of study the use of bacterins or dead cultures of unattenuated strains of *B. abortus* has been tried out alongside the employment of living vaccines or cultures, and in the hands of many world-famous workers very useful results would appear to have been obtained so far as the number of abortions is concerned. The following is a summary of the results recorded, giving the names of the workers and the country in which the work was carried out :—

	Vaccinated with Living Cultures.	Vaccinated with Dead Cultures.	Unvaccinated Controls.
United States :—			
Theobold Smith (Government)	57	..	163
Abortions .. (per cent.)	14·0	..	28·8
Hadley (Wisconsin)	439	..	101
Abortions .. (per cent.)	14·1	..	31·2
Great Britain :—			
Stockman (Government)	439	110	432
Abortions .. (per cent.)	6·5	23·0	23·4
Germany :—			
Zwick, Zeller, Krage, and Gminder (Government)	440	886	1,356
Abortions .. (per cent.)	6·36	13·2	18·06

	Vaccinated with Living Cultures.	Vaccinated with Dead Cultures.	Unvaccinated Controls.
Denmark :—			
C. O. Jensen (Government)	447	..	424
Abortions .. (per cent.)	23·7	..	36·8
Oluv Bang	772	624	..
Abortions .. .. (per cent.)	16·3	39·7	..
France :—			
M. Rinjard (Government)	188	..	60
Abortions .. .. (per cent.)	9·57	..	28·33

These results would appear to be very encouraging, and no doubt the findings of the famous workers named were responsible for the policy now being pursued in the countries specified. Again, it would appear that the use of the dead vaccines or bacterins is hardly justifiable in view of these results, and accordingly its use has been discontinued in most countries.

It has been shown that the use of the living vaccine leads to infection, and that in certain animals it would certainly cause an abortion ; but in others which have already aborted a tolerance to the disease is produced, with the result that the number of abortions in such animals will be reduced, but not necessarily the number of abortions in the herd when new and susceptible animals are being or have been introduced.

In interpreting the success or otherwise attending the use of vaccines, either dead or living, it is important to remember certain facts concerning the disease. Firstly, many abortions are not due to *B. abortus* infection ; secondly, many animals in the herd have already acquired a tolerance to the infection, and therefore will not abort ; thirdly, many animals in the herd may still be uninfected, and unless vaccinated may not abort, these, of course, usually including first calvers ; and, finally, many cows will benefit by this artificially produced tolerance. In view of these facts, many of the figures recorded above may be unreliable and this would account for the lack of success in the application of living cultures of the unattenuated strains of *B. abortus* in practice.

Great Britain.—The use of the bacterin has been discontinued in Great Britain, but the living vaccine is still supplied by the Government to veterinary surgeons for use in the field. Records of results obtained by the use of such vaccine are not available, but, in the writer's experience, in the absence of proper hygienic measures in the herds vaccinated more harm than good has accrued from the indiscriminate use of living cultures of *B. abortus*. No organized attempt has been made in Britain to control or eradicate contagious abortion. The Epizootic Abortion Order has been in force for the past eight years.

Denmark.—The use of the live vaccine is permitted by the Government, but it is here prepared and issued by Professor Bang, of the Veterinary College, Copenhagen. Diagnosis is carried out in the Government laboratory free of charge, but the onus of reporting is placed on the farmer by a contagious-abortion order as in Britain. The effect of *B. abortus* infection on sterility has been carefully studied by Professor Folmer Neilsen, of Copenhagen, and he reports that there will be very little infertility, and that a mild type, in a herd free from contagious abortion. Again, "chronic" infection gives rise to very serious forms of sterility, and "acute" infection seems to have less tendency to aggravate sterility, probably because the abortions then

occur relatively early in pregnancy, so that involution is more satisfactory. In this connection it must be noted that Professor Neilsen is dealing with cases of sterility consequent on endometritis, retained membranes, &c., and not with "temporary sterility" as it is known in New Zealand.

Sweden.—The use of the live vaccine is prohibited in Sweden, and the bacterin is prepared and issued by the Government, which assists in diagnosis and control. The bacterin was used intravenously in the earlier days, but too many accidents attended its use, and accordingly a subcutaneous injection is now carried out at monthly intervals. No success can be claimed for the use of the dead vaccine.

Norway.—Living vaccines are used here in control of *B. abortus* infection, and a special order exactly on the same lines as in Denmark is in force.

Germany.—Both the bacterin and living vaccine are employed, and good success is claimed for their use; the latter, however, is preferred. The diagnosis and production of the vaccine are in the hands of the agricultural societies and veterinary colleges, which, of course, are subsidized for this work. Three years ago a central committee or commission was appointed to organize the control and eradication of breeding-diseases, and an attempt has been made to standardize the work and direct the policy of the State. Contagious abortion is tackled under three heads—(1) hygienic measures, (2) vaccination, (3) sterility treatment. The greatest importance is being given to preventive or hygienic measures, and unless the owner is prepared to carry out the work, and to continue to do so, vaccination is not undertaken. Since so many breeding anomalies arise from infection with *B. abortus*, it is considered essential that uterine irrigations should be carried out, and more especially so in cases of retention of the afterbirth. Vaccination is usually carried out from four to six weeks after the act of abortion, two injections being given at an interval of fourteen days, and service is not permitted for at least another fortnight. One of the reasons why vaccination with living cultures is favoured in Germany is the fact that this method of intervention is considered to have a beneficial effect on subsequent sterility.

Holland.—A special commission has been appointed to consider the whole matter of contagious abortion, but at the time of the writer's visit this commission had not met. In Friesland the control and eradication of *B. abortus* infection is in the hands of the Hygienic Control Service. Living vaccine is favoured as in Britain, and good results are claimed for its use.

Belgium.—The State issues a living vaccine prepared as in Britain; one injection is given at least six weeks before service, and again the year following. Great success is claimed in badly infected herds.

France.—Under the direction of MM. Vallée and Rinjard, of the National Research Institute, Alfort, a definite plan of campaign is being followed. In many herds vaccination with the living vaccine is permitted, and where the herd has been divided the infected group only are vaccinated as already described. The scheme discussed at length by the writer would appear to cover most of the points outlined by these workers. It is of interest, however, to record the method of intervention practised when the whole herd is to be vaccinated with

living cultures. The herd is first divided into four groups after the initial agglutination test, and treated as follows :—

Non-pregnant Animals.		Pregnant Animals.	
Infected.	Non-infected.	Infected.	Non-infected.
Group 1.	Group 2.	Group 3.	Group 4.
One injection of living culture	Two injections of living culture at fourteen-day intervals	Intervention useless	Intervention dangerous; isolate from Groups 1, 2, and 3.
		Await calving or abortion, and proceed as follows :—	
These animals must on no account be served till at least two months after the last injection.		One injection as in Group 1	Two injections as in Group 2.

This immunization must be repeated for each animal after each calving or abortion. Satisfactory results have been reported as attending such methods of intervention.

In all countries the method of preparation of the vaccines varies in minor details only, and so also the procedure for immunization, but the principle involved is, comparatively speaking, the same. Only non-pregnant cows are vaccinated, although some additional success is claimed in Germany for two injections, one before service and the other early in pregnancy.

Reports from America regarding the use of vaccines prepared from an attenuated strain of *B. abortus* would seem to justify an intensive study of the matter. The strain used is said to be non-virulent for guinea-pigs by ingestion or subcutaneous injection, and appears to be able to protect a guinea-pig against a natural infection of *B. abortus* for at least six months. The use of the living cultures of this strain in pregnant and non-pregnant cows has not been attended with any untoward results, and it is also reported that the organisms are not to be found in the milk after vaccination of the subject. Experimental evidence would suggest that its use in bovines is justified, since a protection for eighteen to twenty-four months against mass infection has been shown to follow the use of such vaccines. If the successes reported for this method of vaccination with living cultures of a non-virulent strain of *B. abortus* can be repeated, great progress will have been made towards the control of contagious bovine abortion.

In conclusion, the writer would summarize the position which arises consequent upon the use of the living vaccines in a herd. It will be evident that the good which the vaccination does is more than counterbalanced by the harm which attends its use.

(1) All animals vaccinated react temporarily or permanently to the blood test, and thus eradication based on the test is impossible.

(2) The sale value of the herd is lowered, unless in a well-organized community where chronic reactors which will breed are an economic proposition for introduction into an already infected herd.

(3) There will always be an infected herd, and the abortions resulting from *B. abortus* cannot be eliminated, or even in many cases reduced within reasonable limits.

(4) Sterility and other breeding anomalies have resulted from the use of living vaccines, hence the breeding-efficiency of the herd is lowered.

(5) The elimination of *B. abortus* in the milk of vaccinated cows suggests the possible increase in the incidence of cases of undulent fever in man caused by *B. abortus*.

It will therefore be evident that vaccination can only be possible under conditions where the animals are sold for immediate slaughter and the milk is pasteurized before use, since ordinary methods of pasteurization suffice to destroy the organism. Such a herd may be retained for breeding purposes when the cows are isolated as nurse cows, and the calves are removed after weaning and isolated before removal for building up a clean herd or as additions to a non-infected herd.

(Series to be continued.)

CHEMICAL CONTROL OF RAGWORT.

EXPERIMENTAL WORK AT MAMAKU.

R. E. R. GRIMMETT and C. R. TAYLOR, Chemistry Section, Department of Agriculture.

FOLLOWING the preliminary observations recorded in the *Journal* for October last, arrangements were made for a comprehensive series of experiments in the chemical control of ragwort to be undertaken at Mamaku Demonstration Farm. These were designed to show the efficacy and cost of treating the plant with various mixtures of the ingredients—salt and sulphate of iron—previously used, under varying conditions of infestation, stage of growth, &c. By the time materials and labour were available the ragwort had already made vigorous growth, many plants being past the optimum stage for successful treatment. This and other circumstances prevented the full programme being carried out, but useful data were accumulated and are presented in the following matter.

Heavy rains experienced during the period in which the experiments were being carried out considerably modified the results that had been hoped for. A little rain following an application of the dry mixture of sulphate of iron and salt proved to be very beneficial, but the continual wet weather had a most adverse effect in that it almost completely washed the mixture from the crown of the ragwort plants. It is highly desirable that at least from three to seven days of fine warm weather should follow treatment: where such has been the case excellent results have been achieved.

Various methods and mixtures were tested over areas of different infestation, and to record observations in a simplified form the results have been tabulated.

The most simple and accurate method of procedure was found to be that of cutting up the paddock to be treated in ½-chain strips marked off with a row of poles, and thoroughly doing that area before a further strip was attempted in the same manner until the whole paddock was completed. It was found that on areas of moderate infestation (say, three thousand plants per acre) two men could quickly and efficiently treat 2 acres per day between them. On other areas the time taken depended, of course, on the amount of weed present and its stage of growth.

Ragwort Control Experiments at Mamaku Demonstration Farm.

No.	Paddock Number and Area treated.	Infestation.	Mixture per Acre.	Rate per Plant.	Approximate Number of Plants per Acre treated.	Approximate Number of Plants per Square Yard.	Cost of Material at 8s. per Hundredweight.	Labour per Acre, in Hours.	Cost of Labour at 1s. 9d. per Hour.	Total Cost per Acre.
				oz.			£ s. d.		£ s. d.	£ s. d.
1	Paddock 10A : 1 acre	Heavy ..	6 cwt. salt and iron (50-50)	½–2	11,000	2⅔	2 8 0	54	4 14 6	7 2 6
2	Paddock 7 : 4 acres	Moderate ..	1½ cwt. salt and iron (50-50)	1	3,000	½	0 12 0	13½	1 3 7	1 15 7
3	Paddock 6 : ¼ acre	Extra heavy	8 cwt. (⅞ salt ⅛ iron) ..	½–2	14,500	3	3 4 0	80	7 0 0	10 4 0
4	Paddock 6 : ¼ acre	Extra heavy	7 cwt. iron alone ..	½–2	12,500	2½–3	2 16 0	72	6 6 0	9 2 0
5	Paddock 6 : ¼ acre	Heavy ..	6 cwt. (⅞ iron ⅛ salt) ..	½–2	11,000	2½	2 8 0	56	4 18 0	7 6 0
6	Paddock 6 : ¼ acre	Moderate to medium	4 cwt. salt alone ..	½–2	7,000	1½	1 12 0	36	3 3 0	4 15 0
7	Paddock 6 : ¼ acre	Heavy ..	6 cwt. (¾ salt ¼ iron) ..	½–2	11,000	2½	2 8 0	56	4 18 0	7 6 0

REMARKS.

No. 1: Uneconomic; good mixture. Ragwort completely died down, but owing to rain and great vitality of old plants, young growth reappearing.

No. 2: Good mixture; sound procedure. This 4-acre paddock was completely cleaned up of all advanced growth in very short time. An excellent example of successful use of this treatment.

No. 3: Excellent mixture; uneconomic. Paddock requires ploughing several times and resowing. Infestation heavy, and cost of labour makes eradication by this method prohibitive. Mixture acts quickly.

No. 4: Poor mixture. Remarks on infestation as above. As iron takes considerable time to act, results not satisfactory. Uneconomic.

No. 5: Infestation too heavy to treat economically. Ploughing seems to be only remedy. Very poor mixture, soon lost after heavy rain.

No. 6: Doubtful results on account of slow-acting character of salt. In a few instances treatment appeared successful.

No. 7: Best mixture; uneconomic. Trial followed by one day's fine weather only. All ragwort was completely exterminated within three days.

NOTE.—The term "uneconomic" as here used refers only to the use of the mixtures under the particular conditions of infestation; it does not refer to the mixtures.

The best and most economic period for treatment appeared to be when the plants were about 3 in. high. They could then be seen distinctly, and required considerably less of the mixture to completely destroy them than was the case when allowed to grow 6 in. to 9 in. high. If permitted to reach anything near maturity before this method of eradication is resorted to the great vitality of the plant makes it necessary for 2 oz. to 3 oz. of the mixture to be used instead of from ½ oz. to 1 oz., and even then favourable weather conditions must prevail for at least one week afterwards.

Careful observation of the results produced by the various mixtures tested seemed to point to that made up of three parts salt and one part iron sulphate as the best. As a matter of fact, the results of this trial were outstanding, the plants being killed far more rapidly and surely with this mixture than with any other. There did not appear to be a great amount of difference in any of the mixtures that were composed of 50 per cent. of iron and over, but a decided difference was apparent when the salt was the dominant constituent. Here the plants were rotted to the roots very rapidly, and if there happened to be rain just following treatment the mixture was found to possess a more retentive character, and hence better results were a feature during both normal and adverse weather conditions.

Spraying was not at all successful, chiefly on account of the size of the plants, although the weather influenced the results quite appreciably. As was the case with the dry mixture, the solution containing the greater amount of salt was the most efficacious; but, interesting to relate, a salt solution alone gave but poor results and an iron solution but little better. These remarks are to be read as referring to the more mature stages of growth. Other small areas were sprayed with more success. Owing to the barrel sprayer not being available, only relatively small areas could be treated by hand-pump. However, several small patches of ragwort about 1 in. or 2 in. high were sprayed with a 10-per-cent. solution of salt and iron (50-50) mixture, and good results would doubtless have been obtained had it not been for the rain. The plants completely died down, but later young growth began to appear. There is sufficient evidence of good resulting from this method to justify a further trial being made at some future date.

In conclusion, from results already obtained, it is safe to assume that if the chemical dry-mixture method for the control of ragwort is commenced when the young plants are only 2 in. to 3 in. high, and under favourable climatic conditions, the cost per acre on farms of moderate infestation (three thousand plants per acre) will be negligible compared with the loss of stock that would probably result if the control of the weed were neglected.

The term "moderate infestation" is here applied to those areas where the weed can be, and is by some farmers, annually controlled by hoeing or grubbing (not mowing). An advantage the chemical method possesses over that of hoeing is that the weed is totally exterminated, and it is also much quicker than grubbing the plant out by the roots. Bruising the crown with the heel of the boot materially assists, with but little extra labour involved. In dealing with heavy infestations, the chemical method was clearly demonstrated to be uneconomic, the cost of labour being prohibitive, as shown in the tabulated results.

Further experiments at Mamaku, including spraying, are being planned for this summer, following mowing of the advanced growth.

THE SOILS OF TOKAANU.

A RECONNAISSANCE SURVEY.

R. E. R. GRIMMETT and F. J. A. BROGAN, Chemistry Section, Department of Agriculture.

IN continuation of the work initiated by Aston on the soils of the North Island volcanic province,* a reconnaissance survey was made by one of the writers (R. E. R. G.) during last winter on the soils in the vicinity of Tokaanu, at the southern end of Lake Taupo. Before discussing results acknowledgment is due to the Geological Survey, and especially to Mr. L. I. Grange, for permission to use and publish his geological map of the district, which was made a basis both for the field investigation and subsequent mapping. Acknowledgment is also due to the Department's Chief Chemist, Mr. B. C. Aston, for facilities and criticism, and to Mr. C. Taylor, who assisted with the field-work.

SOIL TYPES AND SERIES.

The soils of this area, which at present is largely idle land, show considerable diversity. They fall into probably three series, with suggested names as follows:—

(1) Taupo Series: Subærial Taupo pumice, comprising coarse sands, coarse sandy silts, sandy silts, and probably fine sandy silts, on the flatter higher ground and over the higher parts of the lower alluvial flats.

(2) Tongariro Series: Water-sorted (alluvial) deposits of recent origin, bordering the Tongariro River and the lake-edge. These comprise coarse sands, fine gravelly sand, coarse sandy silts, fine sandy silts, sandy loams, silt-loams, and loams. They consist of mixed particles of andesite, greywacke, and rhyolite.

(3) Tokaanu Series: So far with only two types—sandy loam and loam, occurring on steep and broken andesite hills and consisting of andesite mixed with Taupo subærial pumice by slipping and soil-creep.

Taupo Series.

This is the dominant series in the district, but in the area mapped it is shown occupying the high ground to the north-west, east, and south-east of Tokaanu. Its characteristics are very similar to those of the Kaingaroa Plains pumice soil between Waiotapu and Wairakei, and, like it, the soil types are restricted to the sand-silt textures, coarse sandy silt, sandy silt, and perhaps fine sandy silt. An area of the latter type occurs on and about the Hautu Prison Farm, and at present it is uncertain where the boundary between alluvial and subærial soils occurs in this locality.

Chemically these soils are fairly rich in organic matter and lime (both available and total), and are moderately well supplied with

* See "A Reconnaissance Survey of Pumice Soils," in November, 1924, and subsequent issues of this *Journal*.

nitrogen, phosphoric acid, and potash when compared with other soils of subærial-pumice origin in the same province. Lime is in considerable excess of magnesia.

Above Waihi Native village a certain amount of dairying is being carried on on soils belonging to this series. A Maori-owned and operated dairy factory is located at Waihi, also a sawmill under the same ownership. At the Hautu Prison Farm sheep-farming is proving highly successful, particularly as regards fat lambs.

In places this series is underlain by a considerable depth of coarse loose pumice, and where the topographical relief is not marked one might expect the possibility of bush sickness occurring. That it has not done so may be perhaps attributed to the interesting fact that under such conditions the pumice soil in this area contains a large amount of black humus, which no doubt modifies its capacity for rendering available and retaining iron that would otherwise be leached out as soon as it became soluble. Fig. 1, showing a soil section at the Rangipo Prison Farm, illustrates this point.

Tongariro Series.

On account of their mixed geological origin (including a considerable amount of basic material), diversity of texture, and low relief the soils of this series will probably prove to be the most valuable in the district. In places along the banks of the Tongariro and Waiotaka Rivers some dairying and cultivation has been and is being carried on, mostly in a somewhat primitive manner, by the Native owners. A large part of the area is in swamp or inundated during the winter.

Bordering the lake is a broad strip of coarse sands which appear to be lake-washed and deposited as beach material. Behind this and bordering the rivers the soil-texture varies widely over short distances, making it impracticable in a reconnaissance survey to map accurately the boundaries of each type. Some quite heavy soils, loams, and silt-loams occur, and should be useful for certain crops.

With their diversity of texture and physical condition the soils of this series naturally vary considerably in chemical composition. Almost all, however, are rich in lime, which is not present as carbonate, thus resembling the Tarawera-Rotomahana series in Rotorua County. The amount of phosphorus, particularly in the available form, shows considerable variation; some soils are comparatively well supplied, while in others this element is somewhat deficient. Total potash is much higher than in the Taupo Series.

Tokaanu Series.

The boundary between the Taupo and the Tokaanu Series where the former overlies andesite depends mainly on the topography—steep slopes leading to admixture of material. For this reason it is somewhat irregular and indefinite, and where shown on the accompanying map must be regarded as tentative. The influence of the andesite is shown in the soil-texture, both types mapped being of a fine or loamy nature—"loam" and "sandy loam" respectively. From the few analyses made it would appear that lime is high in this series also. There is nothing

exceptional in the remaining figures, except perhaps the high lime-requirement and organic-matter content, which may not be constant features.

It would also appear that washings from the hills have spread over the adjacent alluvial flats, thus bringing them within the scope of the

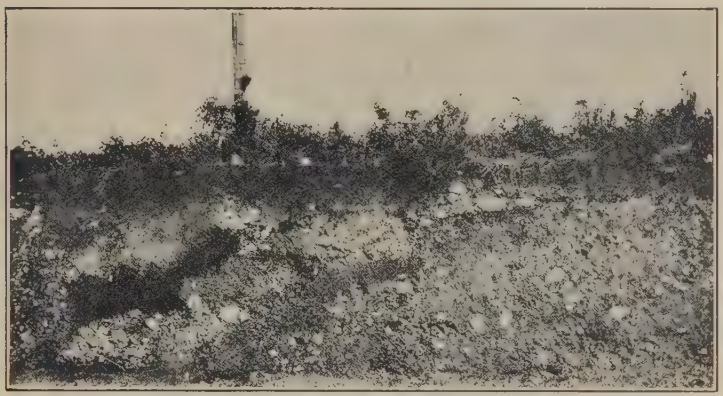


FIG. 1. SECTION OF HUMUS SOIL DEVELOPED ON COARSE PUMICE AT RANGIPO PRISON FARM.

On left is seen a very marked "pocket" of humus (black), probably washed into a cavity in the pumice.

FIG. 2. VIEW OF WAIHI NATIVE VILLAGE FROM ABOVE SCARP.

series. Many of the hill-slopes are probably too steep for successful cultivation, but profitable use might be made of the land in the immediate vicinity of Tokaanu Village.

An interesting case is that of the huge slip of 1846, which overwhelmed the Maori settlement in the vicinity of Waihi Village. The immediate cause was thermal activity along the fault-scarp known as the

Steaming Cliffs. As a result a large quantity of andesitic and thermally altered material has been brought to the surface, producing a bouldery but heavy loam soil.

VEGETATION.

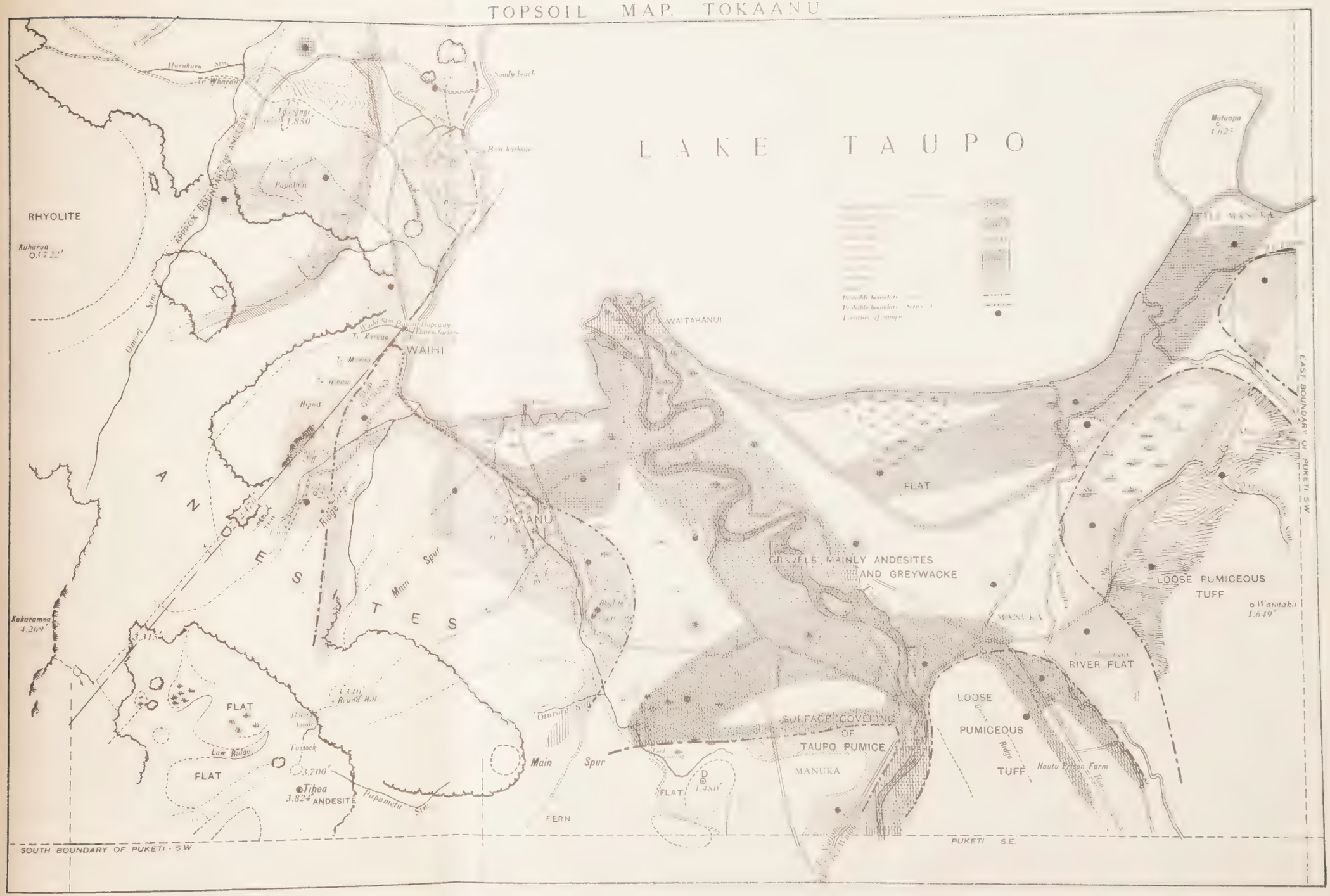
The vegetation of the area is not only considerably varied, but has been altered by burning, milling, and introduced plants.

FIG. 3. VIEW OF TONGARIRO VALLEY, WITH MANGANAMU HILL AND TOKAANU ON RIGHT.

FIG. 4. MAORI DAIRY-FARM ON HILLY LAND ABOVE WAIHI VILLAGE.

On the plateau above Waihi Village, on coarse sandy silt of the Taupo Series is a large area of heavy timber which is now being milled, though sufficient remains in its primitive state to give an indication of its character. Large trees consist principally of matai (*Podocarpus spicatus*) and totara (*P. totara*) ; rimu (*Dacrydium cupressimum*) is scarce. Other forest trees are *Knightia excelsa, Hedycarya arborea, Weinmannia racemosa, Melicytus ramiflorus,* and *Elæocarpus dentatus.* Shrubs and

TOPSOIL MAP, TOKAANU



Chemical Analyses of Tokaanu Soils.

Results, except *, are percentages on soil dried at 100° C.

Laboratory No.	Locality.	Volatile Matter.			Total Nitrogen.	1 per Cent. Citric acid Extract: Dyer's Method, Hall's Modification ("Available Plant food").				Hydrochloric-acid Extract ("Total Plant-food").				Lime requirement (per Cent. $CaCO_3$).	
		*On Air-drying.	*At 100° C.	On Ignition.		Lime (CaO).	Magnesia (MgO).	Potash (K_2O).	Phosphoric Acid (P_2O_5).	Lime (CaO).	Magnesia (MgO).	Potash (K_2O).	Phosphoric Acid (P_2O_5).	On Air-dried Soil.	On Soil dried at 100° C.
Z	*Taupo Series.*														
176	Hautu Prison Farm—behind house	20·8	5·6	13·1	0·324	0·176	0·044	0·025	0·011	1·91	0·40	0·12	0·09	0·36	0·38
178	Hautu Prison Farm—front flat paddock	29·0	3·1	12·4	0·328	0·177	0·040	0·019	0·020	1·08	0·31	0·19	0·10	0·33	0·34
189	Flats south-east of Lake Rotoaira	24·7	6·3	9·3	0·310	0·101	0·020	0·014	0·007	2·57	0·70	0·13	0·07	0·33	0·35
191	Rangipo Prison Farm	31·4	5·1	13·5	0·326	0·147	0·030	0·015	0·010	2·10	0·44	0·11	0·08	0·40	0·42
193	No. 2 paddock, Rangipo	34·5	4·6	14·4	0·400	0·173	0·044	0·021	0·009	1·75	0·40	0·10	0·08	0·46	0·48
219	Omaho 1—rhyolite hills east of Taupo Road	26·7	3·4	10·2	0·219	0·123	0·036	0·016	0·012	1·14	0·28	0·09	0·07	0·28	0·29
225	Puketi 11—flats	28·0	5·2	14·4	0·305	0·144	0·047	0·020	0·014	1·78	0·42	0·14	0·09	0·43	0·45
245	Puketi 9—Native dairy farm	24·5	5·6	13·1	0·321	0·149	0·035	0·014	0·008	2·20	0·48	0·11	0·07	0·45	0·48
239	Puketi 5—matai-totara forest	34·6	4·5	13·8	0·331	0·181	0·035	0·016	0·010	1·25	0·28	0·07	0·07	0·41	0·43
231	Puketi 5—above scarp on edge of Lake Taupo	28·1	6·2	14·0	0·319	0·168	0·036	0·015	0·001	1·67	0·61	0·10	0·08	0·35	0·37
223	Puketi 11—between Mangakoura and Waimarino Streams	..	3·9	10·0	0·210	0·146	0·035	0·022	0·007	1·44	0·50	0·28	0·06	0·30	0·31
227	Puketi 11—hill-slopes														
235	Puketi 5—forest at end of tram-line road	..	4·3	11·5	0·331	0·221	0·010	0·021	0·007	1·48	0·36	0·08	0·07	0·34	0·35
237	Puketi 5—hills 150 ft. above level of preceding sample														
	Tongariro Series.														
197	Puketi 10—edge of swamp east of Manganamu	34·8	12·5	11·4	0·336	0·076	0·018	0·009	0·001	2·24	0·78	0·29	0·07	0·38	0·43
207	Puketi 10—alluvial flats	27·5	5·7	11·3	0·285	0·151	0·050	0·015	0·006	2·62	0·94	0·32	0·11	0·20	0·21
199	Puketi 10—flats near Tongariro River	36·8	2·7	9·5	0·273	0·122	0·030	0·014	0·004	2·48	0·62	0·18	0·05	0·23	0·23
211	Puketi 11—large paddock	21·7	1·9	7·2	0·188	0·116	0·026	0·019	0·008	2·73	0·64	0·20	0·08	0·25	0·25
203	Puketi 10 flats beside Tongariro River	15·2	3·8	5·0	0·130	0·085	0·018	0·032	0·003	3·09	0·66	0·17	0·05	0·13	0·14
205	Puketi 11—flats beside Tongariro River	10·7	5·9	8·6	0·208	0·106	0·060	0·016	0·005	3·62	0·56	0·15	0·07	0·26	0·28
249	Puketi 10 alluvial flats south-east of Manganamu	29·2	7·5	12·9	0·342	0·109	0·029	0·015	0·005	2·40	0·76	0·29	0·09	0·35	0·38
209	Puketi 11—swamp flats between Hautu and Lake Taupo	37·8	4·4	12·9	0·304	0·113	0·027	0·013	0·007	2·53	0·48	0·12	0·08	0·32	0·33
217	Puketi 11—swampy flats	25·6	2·9	8·4	0·243	0·162	0·031	0·012	0·013	1·26	0·52	0·37	0·09	0·23	0·24
221	Omaho 1—west of Taupo Road	26·5	2·0	9·7	0·133	0·062	0·011	0·008	0·013	0·93	0·44	0·34	0·06	0·16	0·16
213	Puketi 11—flats between Hautu and Lake Taupo	44·7	8·0	15·1	0·161	0·172	0·062	0·017	0·011	1·32	0·74	0·45	0·14	0·37	0·40
229	Puketi 11—flats along Waitotaka Stream	35·1	4·6	11·1	0·293	0·157	0·039	0·014	0·014	1·69	0·62	0·47	0·14	0·32	0·34
251	Puketi 10—flats near Tongariro River	34·2	6·5	11·0	0·369	0·078	0·010	0·010	0·003	1·47	0·36	0·09	0·05	0·33	0·35
	Tokaanu Series.														
195	Puketi 10—edge of raupo swamp near Tokaanu	6·3	5·3	20·5	0·773	0·180	0·045	0·034	0·010	2·21	0·42	0·16	0·12	0·47	0·50
241	Puketi 10—hills above road between Waihi and Tokaanu	26·5	8·7	16·1	0·322	0·152	0·051	0·029	0·007	1·72	0·42	0·13	0·06	0·57	0·62

Analyses by F. J. A. Brogan and E. B. Davies.

Mechanical Analyses of Tokaanu Soils.

Results are percentages on air-dried soil.

Laboratory No.	Description of Soil. (Classification of United States Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.								Stones and Gravel.	Soluble Matter.	Locality.
		Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture.	Loss on Ignition.			
Z	*Taupo Series.*											
176	Sandy silt	3·7	28·0	27·3	13·7	6·2	2·8	5·6	12·4	11·0	1·5	Hautu Prison Farm—hills behind house.
178	Sandy silt	1·6	17·0	28·5	25·3	9·2	4·0	3·1	12·0	11·4	3·7	Hautu Prison Farm—front flat paddock.
180	Sandy silt	2·0	26·7	30·3	10·5	7·3	4·2	6·3	8·7	8·2	3·6	Flats south-east of Lake Rotoaira.
191	Sandy silt	2·0	28·2	27·3	14·0	5·2	3·0	5·1	12·8	11·8	3·3	Rangipo Prison Farm—between road and plantation.
193	Coarse sandy silt ..	2·3	31·1	27·0	10·3	5·2	2·5	4·6	13·7	6·9	4·8	Rangipo—terraces above Tongariro River
219	Sandy silt	8·2	27·1	23·2	16·7	6·0	3·3	3·4	9·9	13·3	3·6	Omaho 1—hills.
223	Coarse sandy silt ..	5·3	35·9	26·7	9·5	6·3	3·2	2·9	7·6	16·7	2·7	Puketi 11—between Mangakoura and Waimarino Streams.
225	Sandy silt	1·4	22·0	28·3	14·2	7·8	3·7	5·2	13·7	16·0	3·9	Puketi 11—flats.
227	Coarse sandy silt ..	2·6	35·0	22·7	7·5	7·2	4·8	4·9	12·3	10·0	3·0	Puketi 11—hill slopes.
231	Sandy silt	4·0	25·8	20·2	14·5	7·5	4·0	6·2	13·2	9·4	1·9	Puketi 5—above scarp.
233	Coarse sand ..	11·0	38·4	20·7	9·3	3·5	2·7	2·9	9·1	14·3	4·0	Puketi 5—undulating fern-country.
235	Coarse sandy silt ..	1·3	27·5	28·1	12·5	4·5	2·2	4·4	16·1	15·4	4·0	Puketi 5 forest.
237	Coarse sandy silt ..	5·1	28·4	27·5	12·5	4·5	2·5	4·1	11·7	11·1	4·0	Puketi 5—hills.
239	Sandy silt	2·5	21·2	24·7	20·5	7·8	2·7	4·5	13·2	7·6	4·0	Puketi 5 milled forest.
245	Sandy silt	2·3	27·4	28·2	11·2	6·3	2·2	5·6	12·4	5·7	4·7	Puketi 9—easy slopes on opposite side of valley to Steaming Cliffs.
	Tongariro Series.											
243	Sandy silt	0·3	27·6	26·6	10·5	7·8	4·2	7·3	12·1	6·1	5·0	Puketi 10—swampy flats, Tokaanu.
249	Fine sandy silt ..	0·1	8·1	35·1	18·0	12·2	4·7	7·5	11·9	4·2	5·5	Puketi 10—alluvial flats.
197	Silt loam	0·1	4·8	24·7	23·2	16·8	5·7	12·5	10·0	4·4	3·3	Puketi 10—edge of swamp to east of Manganamu.
199	Coarse sandy silt ..	2·2	33·6	25·8	10·3	11·0	2·2	2·7	9·2	5·3	3·2	Puketi 10—flats near Tongariro River.
203	Fine sandy silt ..	2·7	23·0	46·5	10·7	4·5	2·5	3·8	4·7	2·2	2·9	Puketi 10—flats beside Tongariro River.
205	Fine sandy silt ..	1·6	22·6	42·6	9·8	4·7	3·0	5·0	8·2	10·0	3·4	Puketi 11—between Lake Taupo and Hautu Farm.
207	Silt loam	0·0	0·2	20·0	33·0	22·8	6·7	5·7	10·7	6·3	2·9	Puketi 10—alluvial flats near mouth of Tongariro River.
209	Coarse sand* ..	2·9	43·0	16·9	7·5	4·8	5·7	4·4	12·3	2·7	3·4	Puketi 11—swampy flats between Hautu and Lake Taupo.
211	Coarse sandy silt ..	0·9	39·9	31·1	9·5	5·5	3·2	1·9	7·1	Trace	3·1	Puketi 11—paddock on flats.
213	Loam	0·9	10·4	21·7	18·5	16·3	8·7	8·0	13·9	12·8	4·2	Puketi 11—flats between Hautu and Lake.
215	Fine gravelly sand ..	25·2	54·7	7·3	4·5	0·3	1·2	1·3	4·5	5·4	1·6	Puketi 11.
217	Coarse sand	14·3	53·8	8·2	4·3	4·2	2·5	2·9	8·2	17·9	2·5	Puketi 11—swampy flats.
221	Coarse sand	11·4	62·7	7·9	3·7	4·5	1·8	2·0	5·2	8·8	1·3	Omaho 1—low swampy flats west of Taupo Road.
229	Sandy loam	1·5	24·8	26·7	12·0	12·2	5·5	4·6	10·6	5·4	4·1	Puketi 11 flats, Waiotaka Stream.
251	Coarse sandy silt ..	3·0	28·9	29·3	13·7	4·7	2·3	6·5	10·3	9·2	2·8	Puketi 10—flats, Tongariro River
253	Sandy loam	14·8	23·6	18·8	8·0	12·2	6·3	3·3	11·3	10·6	3·6	Tokaanu 4—flats, Tauranga-Taupo River.
255	Coarse sand	11·8	51·2	16·9	5·0	3·0	2·0	2·6	7·4	15·0	2·7	Tokaanu 4—flats, Waitetoko.
	Tokaanu Series.											
195	Sandy loam	0·2	22·0	27·9	9·7	5·0	5·5	5·3	19·4	3·1	5·8	Puketi 10—edge of raupo swamp near Tokaanu.
201	Sandy loam	1·1	14·3	24·5	13·0	14·5	10·5	9·6	11·6	22·2	2·5	Puketi 10—slopes of Manganamu Hill.
241	Sandy loam	1·0	23·1	24·4	12·2	8·3	6·7	8·7	14·7	11·7	4·4	Puketi 10—hills between Waihi and Tokaanu.
247	Loam	3·3	17·8	12·3	12·0	17·2	18·5	11·2	9·7	13·9	1·4	Puketi 9—bouldery landslide near Waihi Village.

* Nearest classification; between coarse sand and coarse sandy silt; nearer to coarse sand.

Analyses by F. A. Denz.

small trees comprise *Brachyglottis repanda, Drimys colorata, Nothopanax arboreum, Coprosma grandifolia* and other species, *Myrsine Urvillei, Pittosporum tenuifolium*, and *Aristotelia racemosa*. Lianes include *Rhipogonum scandens* and various climbing-ferns. Epiphytes present are *Astelia* sp., &c., and filmy ferns. Tree-ferns and others also occur. No tawa, southern-beech, or tanekaha were seen.

In another adjacent patch of forest that had been longer milled the following were also noticed: *Fuchsia excorticata, Solanum aviculare, Geniostoma ligustrifolium*, and *Schefflera digitata*.

There is also in the same locality a considerable area of open fern country, off part of which, at least, forest has once been burnt. In many places this is now almost pure bracken-fern, with scattered plants of manuka and tutu. In other places it gives way to heath-like vegetation, including *Pimelia lævigata* and *Leucopogon Fraseri*. Fern also covers much of the area included in the Taupo Series in the vicinity of Rangipo Prison Farm.

On the Tongariro Series the two dominant primitive associations are raupo swamp in the wettest parts near the lake-edge, and a kind of wet "herb meadow" inland around the swampy border of the raupo. In drier places there are also dense thickets of manuka and blackberry, but these are both probably of a secondary nature. The herb meadow is scattered over with clumps and single trees of manuka (*Leptospermum scoparium*). Various species of rushes, sedges, and *Juncus* comprise the larger vegetation, while between these the ground is carpeted with moss, *Plantago* sp. *Violas, Pratias, Gunnera prorepens, Ranunculus* sp., and other small herbs. In addition *Lotus major* and white clover occur wild.

Manganamu Hill (it is doubtful in which soil series it should be included, if in any) presents an interesting facies of vegetation, much of it perhaps being secondary. *Leptospermum ericoides* and *Nothopanax arboreum* (20 ft.) are dominant in many places. Other plants are *Pittosporum tenuifolium, Weinmannia racemosa, Coprosma lucida, Myrsine Urvillei, Brachyglottis repanda, Knightia excelsa, Coriaria ruscifolia, Veronica salicifolia, Gaultheria rupestris, Pomaderris phylicæfolia, Geniostoma ligustrifolium*, seedling rimu and southern-beech, ferns, &c.

CONCLUSION.

While it is not pretended that the map delineates the exact boundaries of the soil types and series, it serves to establish their existence, and to show that over limited areas considerable potentialities exist from a farming point of view. Certain peculiarities of the soils, such as their high lime content, are also worthy of note.

The results obtained by the prison authorities at the Hautu and Rangipo prison farms testify to the healthiness and productivity of some types at least of these soils. The genial climate and the manner in which sound farming methods have been applied must be given due credit in this connection. That lambs reared on Hautu should have obtained top price in the open market is a significant fact. There is perhaps no better index to the evaluation of soil than that supplied by the growth and health of the lamb.

FARMERS' FIELD COMPETITIONS.

TARANAKI, WANGANUI, AND FEILDING DISTRICTS, SEASON 1928–29.

J. M. SMITH, Instructor in Agriculture, New Plymouth.

FARMERS' field competitions were conducted last season in the Provinces of Wellington and Taranaki on lines similar to those of preceding years. A very large increase in entries was again experienced, the figures for the past three years being 268, 370, and 503 respectively. The total entries received from the different districts were as follows: North Taranaki, 345; South Taranaki, 96; Wanganui, 20; Norsewood, 13; Feilding, 15; Wairarapa, 14. It will be seen that North Taranaki had the greatest number of entries, the reason for this probably being that in this district a strong competition executive representative of all farming bodies is established, and organizes and controls practically all competition work.

A pasture competition was commenced in North Taranaki last spring, and its value was at once recognized. It was fully reported on in the *Journal* for February, 1929. This competition is being greatly extended in the current season, as the farmers are fully alive to the benefits to be derived from it.

MANGELS.

Ninety-three crops of mangels were judged during the season under review, and the average yield per acre was 59 tons 14 cwt. The heaviest crop judged was that grown by J. N. Blyde, Lepperton, which weighed out at 114 tons 4 cwt., and won the Sutton Cup for North Taranaki. The variety was Prizewinner, and sowing was at the rate of 5 lb. per acre, with 6 cwt. of manure. In South Taranaki the Sutton Cup was again won by H. Betts, sen., Okaiawa, whose crop turned the scales at 108 tons 16 cwt. per acre. Mr. Betts, who is now in his ninety-third year, has been the successful competitor in South Taranaki for the last three seasons, with crops of 128 tons 19 cwt., 106 tons 2 cwt., and 108 tons 16 cwt. respectively. Mr. P. Turner, of Brunswick, grew the heaviest mangel crop in the Wanganui district with a crop of 94 tons 1 cwt.; Mr. J. R. Thompson was the winner in the Norsewood district with a 52 ton 4 cwt. crop; and Mr. A. Kidd secured first place in the Feilding district with a crop of 69 tons 19 cwt.

Worthy of record in connection with the growing of mangels is the crop which was grown by Mr. J. B. Hine, of Toko, for the fifth consecutive year in the same ground, and which weighed out at 63 tons 17 cwt. The five crops weighed 89 tons, 111 tons, 90 tons, 122 tons, and 63 tons respectively.

CARROTS.

Carrots generally were good, and the thirty-nine crops weighed averaged 41 tons 7 cwt. per acre. The heaviest crop weighed during the competitions was that grown by R. H. Jones, Tataraimaka, which weighed out at 67 tons 8 cwt. This crop, of the White Belgian variety, was grown in 7 in. drills, and the heavy yield was the outcome

of a great amount of hand work; some of the carrots stood over 18 in. out of the ground. This crop won the Competitions Committee's cup. In South Taranaki J. J. Sulzberger, Mangatoki, won the championship with a crop of Matchless White weighing out at 64 tons 18 cwt., while G. Hells, Norsewood, grew the winning crop in this latter district.

SWEDES.

The growing of swedes still appears to be on the increase in certain districts, although dry-rot took a heavier toll of the crop during the 1928–29 season than has been the case for several years past. The average yield for 120 crops judged was 38 tons 14 cwt. per acre. The heaviest crop judged during the season under review was that grown by J. L. Corlett, Ratapiko, which turned the scales at 67 tons 3 cwt. and so won the Polson Cup. The variety was Knockdon, and sowing took place on 14th December, 1 lb. of seed per acre being used. In South Taranaki C. Cook, Lowgarth, grew the winning crop of 58 tons per acre, while in the Norsewood district E. Smith topped the list with a 26-ton crop. Booth Bros.' crop of 50 tons 12 cwt. secured premier honours in the Feilding district, while A. Tocker, Tauherenikau, with a crop of 42 tons 19 cwt., won in the Wairarapa.

SOFT TURNIPS.

The only competition for soft turnips was conducted in South Taranaki, where A. D. Johnson's crop, weighing out at 44 tons 12 cwt. per acre, topped the list. The average for the eight crops judged was 41 tons 5 cwt.

CHOU MOELLIER.

Eleven chou moellier crops judged averaged 31 tons 13 cwt. per acre, and the heaviest crop weighed was grown by J. L. Corlett, Ratapiko, which turned the scales at 48 tons 13 cwt. This crop was sown on 23rd December at the rate of 2 lb. per acre. Liberal use of farmyard manure was no doubt responsible to a large extent for the heavy yield.

ENSILAGE.

Ensilage competitions were confined to Taranaki during the past season, and there were 130 entries. The making of ensilage is now a matter of annual practice on most dairy-farms in this province; so much is this so, in fact, and so satisfactory are the results, that ensilage is slowly taking the place of roots and other supplementary fodder crops. In 1928–29 two definite classes were made for ensilage so far as the competitions were concerned, one being for pits and one for stacks. In the pit class are included all the hillside silos (or semi-pits), and as it is felt that this latter type can hardly compete favourably with the complete pit a separate class will cater for it in future.

The stack class was won in North Taranaki by C. B. Lepper, Lepperton, whose stack gained 93½ points (possible 100), and so won the Farmers' Fertilizer Co.'s Cup. The material was from pasture eighteen years old, which had been top-dressed previously with slag. Cutting commenced on 11th December just as the crop was breaking into flower. The stack measured 20 ft. square, and was built to the height of 7 ft. the first day; forty-two hours were allowed to elapse, and then 9 ft. was added; after a further eighteen hours another 11 ft.

was added; and twenty-two hours later the stack was completed by the addition of a further 12 ft. A foot depth of soil was put on the next day, and held well out by poles. The topping was almost ideal and the waste greatly reduced, as evidenced by the points awarded—23 out of 25.

One of the greatest weaknesses brought out by the competition was the tendency on the part of many of the competitors to unduly delay cutting, with the result that much of the sap had gone out of the plant, and consequently the temperature rose too high. This results in a dark ensilage lower in value than the green. Cutting a week or a fortnight earlier would have been very advantageous in many cases.

The advantage of having the soil held well out to the edges of the stack was again demonstrated, and many and varied were the devices and methods adopted to bring about this desirable state of affairs. Worthy of special mention was the style used by Mr. F. T. Crowe, of Lepperton. Heavy wire netting was run round the top of the stack and held in place by wires threaded through the netting. Sods were then placed against the netting, and these in turn were backed up by the soil. It would have been an advantage, however, had it been possible to tighten the wires occasionally, and no doubt arrangements will be made for this on future occasions.

Mr. G. H. Bell, Oakura, again won the championship in the pit class, his entry scoring 95½ out of a possible 100. The material again turned out in splendid condition, and the total waste from the whole pit could have been removed in a wheelbarrow. Mr. E. J. Locke, Hillsborough, scored second place with 95 points, and had the waste in this pit been less it must have won the competition.

The advantage of the concreted pit was again demonstrated, the small amount of waste and the facilities for handling being the strong features. It is fairly evident that to secure the best results a pit should be roofed; and there is no doubt that much greater waste occurs where the pit is open to the elements. It is obvious that in a district where he rainfall is fairly heavy the rain falling directly into the pit must cause deterioration. Another interesting feature of the pit class was that all the pits which scored high points had perpendicular walls.

HAY.

The competition for haystacks proved very popular in Taranaki, there being seventy-two entries. Although the average for quality of hay was not high, this was more the fault of the weather than of the farmer. The building was again a credit to most of the competitors. Quite a number of stacks were again thatched, but the largest number were covered with iron.

The stack which won the List Cup in North Taranaki was that entered by H. Wallace, Lepperton, which scored 93 points out of 100, the loss of points being mainly due to quality deficiency. The best-built stack was that of G. H. Bell, Oakura, which was awarded 24½ points out of 25.

GENERAL.

The organization of the competitions was on lines similar to those of previous seasons; in North Taranaki a central executive controlled

the movement and awarded championship prizes in all sections, although the detailed organization was left to the various branches. Judging was again carried out by officers of the Fields Division, and

FIG. 1. HAYSTACK ENTERED BY MR. G. H. BELL, OAKURA, WINNER OF THE BEST-BUILT CLASS.

FIG. 2. A GOOD TYPE OF DUTCH BARN ON MR. BELL'S FARM.

Hay is put in from bank above, part of the iron roof being removed for that purpose.

as usual the Department of Agriculture awarded certificates of merit to all competitors who secured places in the various competitions.

Thanks are due to the donors of the various prizes and trophies, and to the various local organizations for their co-operation.

CONTROL OF CODLIN-MOTH IN ORCHARDS.

J. H. THORP, Orchard Instructor, Nelson.

A remit appeared on the agenda paper of the annual conference of the New Zealand Fruitgrowers' Federation this year to the effect that the control of codlin-moth should receive special attention by the Department of Agriculture. So much has been written during the last few years in connection with this pest, and so many investigations and experiments have been undertaken, that it is rather surprising to find the subject still a debatable one. That such was the position, however, was abundantly evident after hearing the discussion, the trend of the debate appearing to emphasize the fact that in some parts control was becoming more difficult, and that the pest was occasioning more loss to growers than had previously been the case.

To some orchardists present, and, I must confess, to myself also, the matter seemed unimportant, but since the conference I have studied the conditions in other fruit-growing countries, and find that the problem of codlin-moth control is also exercising the minds of some fruitgrowers in the United States, and also in Australia, where the losses due to this pest are assuming far greater proportions than was previously the case.

Personally, I feel quite convinced that all that is needed to keep this pest under practically absolute control in this country is the use of arsenate of lead regularly and efficiently applied, plus careful and sustained orchard sanitation. The truth of this assertion can be substantiated by careful growers in any of the fruit districts; and it may well be asked, if some can attain such results, why not all? I believe the answer can be found in the fact that all growers do not regularly and efficiently apply the sprays, and do not give enough attention to the destruction of infected fruit, the neglect of which perpetuates and increases the infection from year to year.

There are sometimes circumstances under which spraying with arsenate of lead may not give absolute control, but I think it will be generally admitted that the specific is not to blame, and we must look to other causes, such as undue delay in commencing the applications, too long intervals between sprayings, unduly wet weather, and failure to renew the applications after rain. Under these circumstances, and in cases where infection may have been excessive the previous season, it is only fair to assume that the possibility of infection will be greater.

Here it may be well to consider what 10 per cent. of codlin-moth infection means. In a 10-acre orchard, with apples averaging 150 to the case, and 300 cases per acre, there would be 45,000 grubs, and if these were not collected and destroyed, it is easy to calculate the number of eggs which would be laid in the ensuing year, supposing half the moths were females and laid 80 eggs each.

Just how many grubs are carried over to the next season will depend entirely on the efforts made to destroy them. A proportion of the grubs leave the fruit while it still remains on the tree, others fall with the apples to the ground, deserting them when full grown, and in either case seek

refuge under the loose bark or in the cracks and crevices in the trees, or in other hiding-places nearby. Those infected apples that remained until picking-time are possibly thrown on the ground, or put into cases, taken into the packing-shed, and discarded at grading-time into old cases, perhaps left for some time before feeding to pigs or tipping out in some odd corner—just a thoughtless act in most cases, and done without weighing the consequences. Under ordinary circumstances the greatest amount of infection will usually be found adjacent to the packing-shed, because the old cases are usually stored there and the season's crop was assembled at that point. This fact alone demonstrates the necessity for taking precautions against future infection.

I commend the following procedure to those growers who may have had difficulty in obtaining satisfactory control of codlin-moth in the past. Thoroughly clean up and destroy all rubbish adjacent to the trees, such as old sacks, timber, &c. Remove branches which overhang old sheds and fences. Remove broken branches and cracked stubs from the trees, also scrape off and destroy the scaly bark, and place a bandage on the trees to trap the escaping grubs, and examine and destroy grubs regularly during the season. Where poles and props are used in the orchard, these also should be searched and cleansed.

When the petals have fallen, and before the calyxes close, spraying with arsenate of lead should commence, and should be continued at intervals of fourteen days up to the end of December, and thereafter every twenty-one days up to the end of February, using from 1½ lb. to 2 lb. of arsenate-of-lead powder per 100 gallons of water, according to the weather conditions being experienced. The addition of ½ lb. of spreader in the later sprays may be found desirable so as to ensure a better covering.

Judicious thinning of the crop will enable a better control to be obtained, but all infected fruit must be destroyed throughout the season, and all windfalls must be collected and dealt with in the same manner.

In the case of mixed orchards it may be difficult to fit in the constant spraying when stone-fruits have to be harvested, but no such considerations should deter an energetic grower from finding the necessary time to save his pip-fruit crop from infection.

I feel certain that in any district concentrated effort could practically eliminate codlin-moth altogether. This is instanced by what has been done in West Australia, which has over 11,000 acres of apples and pears. Between the years 1903 and 1928 there have been eleven outbreaks of codlin-moth in that State, and all have been stamped out. In 1925 the number of places found to be infected was eighty-one, grubs being found in thousands, and this outbreak was stamped out without destroying the sound fruit or the trees. To-day it is estimated that the absence of the moth saves the West Australian growers some £43,000 yearly. Such results as these should stimulate New Zealand fruitgrowers to adopt every known method to rid their orchards of this destructive pest without the necessity of compulsion.

WAIMATE WEST DEMONSTRATION FARM.

NOTES ON OPERATIONS FOR 1928–29.

J. W. DEEM, Chairman of the Farm Committee.

THE season of 1928–29 on the whole was quite a good one for milk-production at the Waimate West Demonstration Farm (South Taranaki), and the butterfat returns showed an increase of 734 lb. for the year ended 30th June last. This is satisfactory when it is considered that several old cows past their best were milked. Fresh cows could have been procured to build up the returns, but we were opposed to buying in fresh stock if it could be avoided owing to the danger of introducing disease. Fourteen yearling heifers bred on the farm are being carried this year, and will go into the herd next season to replace old cows.

The financial position of the farm continues to improve, the overdraft at the close of the year standing at £1,450, as compared with £1,939 in 1928, a reduction of £489. Sales of pigs amounted to £69, showing an increase of £17. Thirty "bobby" calves were sold and netted an average of 9s. 10d. per calf, against 5s. 2d. in the preceding year. The valuation of live-stock stands at £735 this year, compared with £721 in 1928. It is also interesting to note that the interest charges, for the past year were only £118, as against £155 for the preceding period. After allowing for the usual depreciation, the assets stand at £3,128.

PASTURES.

The farm pastures have to a great extent recovered from the grass-grub invasion mentioned in last year's report (*Journal*, November, 1929), but one or two fields were still badly affected during the past season. Probably now that the grub has gone over the whole of the farm it will be comparatively free from this pest for a time.

The tests between old-pasture perennial rye-grass and ordinary perennial rye in Field 4 are still very striking. The fundamental grassland research areas in Fields 5 and 8, laid down by Mr. E. B. Levy, Agrostologist to the Department of Agriculture, present some striking comparisons, and are always worth a visit.

POTASH TOP-DRESSING EXPERIMENT.

This experiment was continued on the same lines as in the preceding year, 24 acres receiving phosphates and potash and 24 acres phosphates only, the grazing being done by the whole herd and factory weights of milk recorded each day. This year the area dressed with phosphates only showed an increase of 2,980 lb. milk, as against a comparative deficiency of 367 lb. for 1927–28, or a net gain of 2,613 lb. for the two seasons. The difference is really small and not very significant, and, when taken in conjunction with ocular observation, does not indicate any marked beneficial results from the use of potash on this farm. It should be mentioned that the fields dressed only with phosphates received extra super equivalent to the cost of the potash on the other fields, and at all times looked the best—if anything, being preferred by the cows—but there was not much difference.

NITROGEN TOP-DRESSING AND ROTATIONAL GRAZING.

Six acres were treated with sulphate of ammonia, in three dressings of 1 cwt. per acre. Very little result was noticeable during the period under review, but early this spring the nitrogen area showed a considerable building-up of the rye-grass content and a marked reduction in catsear.

An area of 24 acres has now been divided up into eight 3-acre paddocks, and water laid on. These fields have all had the same phosphate-manuring; but four have received an additional 2 cwt. of sulphate of ammonia per acre, the intention being to graze the whole eight fields on the most approved methods and record results to determine the value of nitrogen top-dressing on this land.

LUCERNE.

The lucerne stand continues to do well. The first cut, as usual, was made into silage, subsequent cuts being used for hay and green fodder. The practice of sowing 1 bushel of oats per acre on a portion of the area has been continued. This greatly increases the first cut for ensilage, and helps to control grass and weeds. Oats have now been used for six years, and so far have had no detrimental effect on the lucerne.

ROOT CROPS.

These were confined to 1 acre each of mangels and carrots, and about 1 acre of green maize. A poor strike was obtained with part of the mangels, and the area was redrilled with swedes, the combination giving a quantity of feed. Carrots and maize were good crops.

A number of varieties of mangels were grown on a special plot, and provided some splendid roots for the Hawera Winter Show. The four best varieties were Ferriston, 110 tons per acre; Red Intermediate, 108 tons; Prizewinner, 102 tons; Barres Stryno, 95 tons. Ferriston is a selection made by Mr. J. W. Hadfield, Agronomist, Department of Agriculture, and is a good cropper.

Hop-disease.—Downy mildew of hop has been declared as a disease under the Orchard and Garden Diseases Act, and included in the First Schedule. Further, the introduction into New Zealand from any country of sets of any variety of hops has been prohibited as from 14th November.

Wool Research.—The Chairman's report at last month's meeting of the Council of Scientific and Industrial Research included the following reference to wool: "The investigations commenced at Massey and Lincoln Colleges are continuing. Arrangements have now been made which will enable Dr. Dry to give additional time to the study of the development of the fleece and its nutrition. Proposals have been submitted by the British Research Association for the Woollen and Worsted Industries, whereby the Dominion may participate in the results of their investigations. This matter will receive the consideration of the Wool Research Committee. A collection of representative fleeces, selected from flocks of known pedigree in both Islands, will be forwarded to Torridon for detailed investigation during the present shearing-season. In order to ascertain the precise uses to which New Zealand wool is being put, special inquiries are now being made in the United Kingdom. This is a most necessary step in order that the local wool-growers may be guided as to the particular nature of the wool required by overseas' buyers."

INTENSIVE ROTATIONAL GRAZING OF PASTURES.

VARIOUS ASPECTS OF THE SYSTEM IN NEW ZEALAND.

A. W. HUDSON, Crop Experimentalist, Plant Research Station, Palmerston North.

INTENSIVE rotational grazing may be described as that system of grazing which enables the whole of the herbage on each of a series of fields to be consumed rapidly by stock while in a young, palatable, and highly nutritious stage, and then permits each field to be closed to stock and rested until the growth is sufficient to warrant the process being repeated. It aims at the provision of a sufficient number of fields to permit of the conversion of as much young grass into animal products for as great a portion of the year as possible, at the same time allowing for the conservation of sufficient hay and silage to provide supplementary feed for those periods when grass-growth is limited.

It may be reasonably contended that the majority of farmers have in the past practised rotational grazing to some extent. Practically every farmer has a number of fields which are grazed in some sort of rotation. The difference, however, between intensive rotational grazing and rotational grazing as ordinarily practised lies in the fact that in the latter case control and utilization of grass have rarely been complete, and have varied from good to very poor utilization. This is evidenced by the fact that it is comparatively rare to find a pasture which does not have a large number of patches of coarse grass that have run to seed after the month of November. The extent of these patches varies according to the degree of utilization during the spring months. Many farmers are inclined to regard this coarse material as evidence of good farming, and as an easy and convenient method of providing against shortage of feed during the late summer, autumn, and winter. Undoubtedly it is an easy method of providing coarse roughage for the low-production periods, and on certain classes of hill country where hay or silage cannot be made and roots cannot be grown there seems to be no alternative method if stock are to be maintained on the farm throughout the year. On land where it is possible to conserve surplus grass or grow supplementary feed, however, the practice must be strongly condemned as being an extremely wasteful method of providing feed for low-production periods. At the best, unconsumed roughage provides nothing more than a maintenance ration for stock, and as the season progresses it becomes more and more fibrous and indigestible. The fact that it is left by stock until they are compelled by hunger to consume it, while patches which have been kept short by stock are eaten as bare as the animals can graze, is a sufficiently good indication of its poor quality.

On the closely grazed patches the better and more palatable plants are continuously nibbled off, and never have a chance to bear much leaf, which is so essential to the plant-life, and they consequently die out. On the rough patches the coarse species exclude light from those species which need it most, such as rye-grass and white clover, and their growth is seriously retarded. The

advantage of the autumn rains, which always induce growth on efficiently controlled pasture, is largely lost where rough patches are abundant.

On the average farm it is not easy to avoid this undesirable condition entirely, but much can be done to improve the present methods—on a large number of farms at least—by adopting a better system of rotational grazing, accompanied by the conservation in the form of hay and silage of herbage which cannot be eaten by stock at the time it is produced.

Methods of Rotational Grazing.

(*a*) ON DAIRY FARMS.

Much valuable experience was gained last season in the management of paddocks under intensive rotational grazing from trials on some eighty farms, with two or more paddocks on each farm under treatment. In suggesting the adoption of this system it is not intended to advocate its immediate introduction to the whole of a farm. By starting with from two to six fields it is confidently expected that a farmer will be so convinced of its advantages that he will need no further persuasion in extending it to include, at least, a larger proportion of his farm.

Size of Fields.—Experience indicates that fields which will accommodate the whole of the milding-herd at the rate of from ten to eighteen cows per acre for short periods are easiest to manage from the point of view of grass-control. The average intensive rate of stocking under New Zealand conditions appears to be about fifteen cows per acre. (Number of cows in herd divided by 15 gives approximately the area for fields in acres). During the months October to December such fields will give from two to three days' grazing for the herd, according to the actual number of cows per acre, stage of growth when stocked, and fertility of the soil. From fourteen to twenty-four days will be required for the herbage to reach the grazing-stage again. Thus if each field provides two days' grazing, and the recovery period is twenty days, ten paddocks would be required to provide the necessary grazing during the period mentioned. The suggestion that a farmer might commence with from two to six fields implies that each field will be grazed only when the herbage has made sufficient growth after spellings of approximately fourteen to twenty-four days.

Reasons for Fields of Size suggested.—As stated, a field stocked at the rate of ten to eighteen cows per acre usually provides feed for two or three days. It is an interesting and noteworthy fact that when cows have been in a field for that length of time they generally show a desire for a change, even though there is still a fair amount of grass unconsumed. With fields of the size advocated most of the feed is consumed in the stated time, and the cows may be removed without much grass being left. With larger fields there is still the desire on the part of the animals for a change, and if not removed the milk-yield will decline. Obviously this is undesirable, so the cows have to be moved while a considerable amount of feed is still unconsumed. This unconsumed herbage, unless otherwise removed, is beyond the palatable stage when the cows

are again put in the paddocks, and is again neglected, those portions previously grazed and giving short, sweet growth being preferred. At each grazing the position becomes worse, until the paddock becomes a mosaic of closely grazed patches and patches of roughage.

Use of Dry Stock as Followers.—In Britain and Germany effective control of pasture has been rendered comparatively easy by the use of considerable numbers of dry stock, which follow the milking-herd after the latter have taken the best of the grazing. In the dairying districts of New Zealand it is very rare to find a sufficient number of dry stock on the farm to serve this purpose effectively. While full use should be made of available dry stock for cleaning up pasture, they cannot be relied upon to do this entirely, consequently it is necessary to make the utmost use of the dairy herd, and this can best be done by having small fields. Even then proper control is not always possible, and in the absence of dry stock the mower has to be introduced to remove the uneaten patches. Whether the mower should follow the dry stock, or whether the mowing should be done immediately after the milking-cows are removed, is a matter for investigation by each farmer. Grass cut and allowed to wilt for a few hours or a day is often eaten in preference to the same class of grass uncut; mowing before the dry stock are brought on to a field will probably result in their concentrating on the cut material, and thus the desired object will be achieved without waste where only a few dry stock are available.

The farmer's difficulty in finding time during the busy season to carry out such operations as mowing and harrowing is fully appreciated, but at least these can be done at some periods, and a proper overhaul of the mower during winter will be of material assistance.

Mowing and Harrowing.—If at no other time, mowing of uneaten herbage should be carried out during November before the usual spring rains cease. Control of herbage after this will not be so difficult, as fresh growing grass is becoming less plentiful and stock tend to graze more evenly. By the end of February it may and generally will be desirable to mow again to remove accumulated roughage and give the grass a chance to come away with the advent of autumn rains. As far as time permits each field should be harrowed with an implement which will spread droppings as soon as stock are removed. This applies particularly to the spring and early summer months, when rainfall is fairly regular. The spreading of droppings results in a good deal of fouling of pasture, but by the time the grass is again ready for feeding off the rain will have washed it clean. During the drier period usually experienced from January to March harrowing has to be suspended, because the rapid drying of manure renders spreading difficult and the fouled grass does not clean so readily. As soon as the autumn rains set in, however, no opportunity of thorough harrowing should be lost. Mowing and harrowing have been mentioned because both are essential to the proper carrying-out of intensive rotational grazing.

Lay-out of Fields.—Where the shape of the farm permits, the ideal lay-out is that of the central race with small fields on either side, each plentifully supplied with fresh water.

The "On-and-off" System.—Mr. R. Lindsay Robb, chief grassland adviser to Imperial Chemical Industries, Ltd. (London), has recently advocated the "on-and-off" system of rotational grazing. Briefly, it is as follows: When a field is ready to graze the cows are put in for one and a half to two hours after the morning milking, during which time they will eat their fill. Before they lie down to chew their cud they are returned to a field which has just been grazed, where cud-chewing takes place and most of the dung is deposited. About mid-day they are put in the new field again for a short time and removed after feeding. After the evening milking another grazing is given on the new field, and the cows are then returned to the grazed field for the night. As the best of the feed is consumed in each field the cows go on to another for short periods, being returned to what was previously their "on" paddock. The advantages of this system in lessening fouling of good grass and thus aiding in its complete utilization are obvious; the method is frequently adopted by farmers in the early spring months, when grass is in short supply and the fullest utilization by milking cows is highly important.

Advantages of Small Fields in overcoming Difficulties.—It will be noticed that the spring and early summer months only have been particularly mentioned in the foregoing remarks. These months are the only ones in which effective control of grass is difficult on most farms. As a rule sufficient stock are carried to ensure full utilization of all growing grass during the period from January to September inclusive. The difficult point to decide in the spring is how many fields can be properly grazed and still provide sufficient feed for stock, and how many fields are to be kept for silage or hay. Here again the advantages of the small fields are apparent. Consider, for example, a 50-acre farm in which the fields are each about 6 acres. Ordinarily 12 acres might provide sufficient hay and silage for supplementary feed. The closing of two fields (12 acres) may still leave an amount of grazing which it would be impossible to control with the stock available, but the closing of three fields (18 acres) may, on the other hand, result in an insufficiency of grazing and the conservation of an unnecessarily large amount of supplementary feed. To close an area intermediate in size between those stated would necessitate fencing and possibly watering at an inconvenient time for the labour available, and consequently would probably not be done. The result would be bad control of grass, or good control but with the punishment of stock. Fields of 3 acres on such a farm would obviate difficulties such as these and allow a greater flexibility of management, so far as area closed and time of closing are concerned. Further, it may be found that the spring promise of a good season is not fulfilled, and that fields which were intended for hay have to be brought into grazing after being closed for a few weeks. Again, the flexibility of management of small paddocks is apparent, for instead of having to break into a 6-acre field a smaller one may be used and may meet the temporary requirements. Hence the small field has the dual advantage of enabling proper control of pasture to be exercised and of providing greater ease of management of the farm.

(*b*) ON SHEEP FARMS.

In the case of sheep-farms situated on easy country there is no reason why intensive rotational grazing could not be carried out on

the same lines as with dairy farms. Fewer fields would be required for a complete cycle of grazing, or the grazing of each paddock would have to be confined to a shorter period. Utilization of herbage at a much shorter stage of growth with sheep than with cows is necessary, and during the height of the growing-season a field should be grazed at seven- to ten-day intervals. Lambing is usually over and lambs sufficiently old to allow of their being moved quietly before rapid growth of pasture begins. A few sheep-farmers are practising the system with great success, and experiments are being conducted to test its advantages. The sale of most of the lambs from the farm at about the stage when pasture-growth is falling off aids materially in management during periods of low production.

Effect of Intensive System on Pastures.

With good perennial strains of rye-grass, cocksfoot, and white clover intensive management is highly advantageous. The control of less desirable species such as Yorkshire fog and brown-top, and the frequent harrowing and spreading of droppings, provides conditions more favourable for the development of the better species, which, if well manured, improve considerably under the treatment.

Non-perennial species, which under good fertility conditions but bad management will reseed and re-establish themselves, can only have a temporary value in a pasture which is to be continuously submitted to intensive management. The very fact that the object of the system is to utilize grass in its young stage and prevent it from becoming rank and running to seed precludes the possibility of much reseeding, and a pasture containing a large amount of Italian rye grass will deteriorate rapidly, even though this grass may have persisted for years under a system of improper control. Consequently it is highly important when the establishment of permanent pasture is contemplated that the seed mixture should contain a high percentage of true perennial rye-grass, and that where cocksfoot and white clover are sown persistent New Zealand strains should be used.

A pasture efficiently controlled during the spring and summer will respond rapidly to autumn rains and yield a larger amount of highly nutritious feed, uncontaminated with roughage, well into the early winter.

Nutritional Advantages of Young Grass.

Valuable work on pastures and pasture plants has been carried out at Cambridge (England), under Dr. Woodman, and at Aberystwyth (Wales), under Professor Stapledon, during the last few years, and some of the information resulting from the work is mentioned in what follows.

It has been shown that young grass is practically equivalent to or better than many concentrates in food value; the digestibility is higher than that of good linseed-cake, being approximately 84 per cent. as against 80 per cent. Young grass has the added advantage of supplying an abundance of vitamins and minerals such as lime and phosphate. A comparison between young grass and hay may be used to illustrate the advantages of the former, because badly controlled grass which has "got away" is practically equivalent to or even less valuable than hay, according to when it is utilized.

The digestibility of medium hay is about 52 per cent., whereas that of young grass is, as stated, about 84 per cent. The dry matter in young grass contains about four times as much digestible protein and over two and a half times as much digestible starch equivalent as the same amount of dry matter in hay. The fibre of young grass is practically as digestible and gives rise to as much sugar in the process of digestion as the starchy content of the grass, whereas the fibre of hay tends to be woody in character and of low digestibility.

In minerals, too, grass has a decided superiority over hay, the dry matter containing about twice as much lime and phosphate as does an equal amount of dry matter in hay. The work at Aberystwyth on the chemical analyses of the leaf and stem respectively of a large number of grasses emphasizes these points very strikingly. The leaf is higher in fats, protein, and minerals than the stem. The stem is higher in fibre and starchy material than the leaf. The great significance of these facts is apparent when intensive rotational grazing is considered. The system effectively carried out induces development and ensures utilization of leaf rather than stem, with the result that the material produced is consumed by the animal in its most nutritious and digestible stage. Grasses such as Yorkshire fog, brown-top, and danthonia, which become coarse and unpalatable if allowed to grow rank, become useful contributors to production when eaten young, and instead of causing rank patches in fields are almost as easily controlled as more valuable species such as rye-grass and cocksfoot.

Manuring for Intensive Grazing.

It would be difficult to decide which is the more important—manuring without intensive utilization of grass or intensive utilization without manuring. The former practice results in a waste, in that full benefit is not derived from the grass produced, while the latter is often difficult, because without manuring the quality and quantity of herbage is seriously lacking. In view of the recognized advantages of manuring, especially with phosphates, it would appear that manuring is the first essential, but the question which immediately arises is, "What is the use of manuring if full utilization is not going to be made of the extra grass produced?" The obvious conclusion is to combine both manuring and intensive utilization, and the farmer who has a definitely limited amount of money available for spending on improvement should see that after spending money on manures he has sufficient left to enable him to erect fencing, conserve feed not required immediately, and purchase stock, to enable him to derive the full benefit from the results of manuring. Lime and the various manures commonly used will be discussed under their respective headings.

LIME.

Where lime is deficient in the soil its use must be regarded as being equally essential to good production as a foundation is to a building. The heavier and wetter soil types are usually regarded as being most in need of lime. This may be so in a general way, but lighter and dryer soils are often as much in need of lime as any others. Every farmer should make it his business to find out whether his soil responds to lime or not. This is easily and cheaply done, the best plan being to dress

comparatively small areas in one or more fields at the rate of from 1 ton to 1½ tons per acre. A strip of a few yards wide across a field will give more information than if the whole area is dressed, because comparisons are more surely made between parts of the same fields than between one field and another. The effect of lime *may* not be apparent for a year or more after application, so that it is very necessary to keep a close watch on its behaviour for two or three years and at all seasons of the year.

A comparatively heavy dressing, as indicated, should be used, because the effect of a heavy dressing is more easily observed than that of light applications. If a heavy dressing gives good results it does not follow that heavy applications must be made to ensure any improvement. The practice of applying a few hundredweight every year must be beneficial if lime is known to give results in heavy quantities, but the same marked response from a light dressing must not be expected as in the case of a heavy one. The effect of lime is usually manifested by an improvement in the quantity and vigour of clovers, and improvement of the better grasses, especially rye-grass, in vigour and density of sward. Stock will often show a marked preference for limed ground, and a more even and closer grazing indicates this preference. Where lime is beneficial the effect of a dressing of 1 ton per acre may reasonably be expected to last for a period of from four to six years, or even longer in some cases. Hence the cost of application may be comparatively small when viewed as an annual cost, and even a slight improvement results in a good financial return in yield, apart from the added benefit to stock.

PHOSPHATES.

Little need be said about the advantages of using some form of phosphate on the great majority of soils. The questions of kind of phosphate and time and quantity of application are, however, matters for consideration on every farm. For the purpose of this article the kinds may be divided roughly into two main groups: (1) Water-soluble phosphate, (2) phosphate insoluble in water.

Water-soluble Phosphate.—Apart from the newer fertilizers, such as Ammophos, Diammonphos, &c., the only commonly used phosphatic fertilizer which is soluble in water is superphosphate. Generally speaking, this phosphate is the most efficient form used. It is certainly the most rapid in effect, and although its effect may not be so prolonged as that of other forms of phosphate this need not occasion surprise. A fertilizer which gives up its material to the plant rapidly cannot be expected to last as long as one which yields its fertilizing-material slowly.

Phosphate insoluble in Water.—Slag, bones, and raw rock phosphates, such as those from Nauru and North Africa, come into this group. They vary considerably in their phosphate content, and a high percentage of phosphate combined with extreme fineness of grinding are the best indicators of value. Under wet and heavy soil-conditions they may be as beneficial as superphosphate, although not so rapid in action, but it is very rare indeed to find these forms of phosphate superior to superphosphate even when used at the same rate per acre. On the lighter soils of the North Island, such as the pumice soils of Auckland Province, there seems little doubt of the superiority of super over other forms. Statements have been made that the continuous use of super

will make the soil acid or increase its acidity, but this has been conclusively disproved. In this connection Sir John Russell, Director of the famous Rothamsted Experimental Station in England, may be quoted. After an address delivered at Palmerston North in 1928 he was asked if the continued use of superphosphate would make the soil sour. His reply was to the effect that superphosphate at the rate of 3 cwt. per acre had been applied to the same ground every year for the past eighty years at Rothamsted. Analyses of the soil had been made from time to time, and so far as could be determined there was no increase in the soil-acidity.

It is not intended to discourage the use of basic slag and other phosphates on soils where these give good results, because, although they may not be any better than super, farmers can rest assured that their use is not uneconomic.

Time of Application.—Recent work conducted by the writer at the Marton Experimental Area indicates that superphosphate has a marked effect on growth of pasture in from four to eight weeks after application, providing rainfall and temperature conditions are sufficient to promote growth. This brings up the very important point of time of application. Manure should be applied at such a time that its maximum effect is obtained during periods of low production. The aim should be the levelling-out of production throughout the year. There is no particular object in applying manure, so that its maximum effect is obtained during October, November, and December, when actual production is naturally at its maximum. (The exception to this is where manuring is done for the express purpose of increasing the yield of hay or silage.) Manuring, then, should aim at increasing growth from January to September inclusive. The greatest limiting factor to production during January, February, and March is moisture. The pasture plants which are responsible for the greatest production during this period, with the exception of well-managed paspalum, are the clovers. Hence the object should be to stimulate their growth as much as possible at this time, and there are definite indications from the work at Marton that this can be done to some extent by an early summer application of superphosphate. The dressing usually applied in August or September should be delayed until October, or even as late as November or early December, where the regular rains can be expected up to Christmas-time. The actual increase may not be large, but any increased growth during the late summer is highly important, and if absence of moisture limits production at that time the benefit from the dressing will be felt immediately after the autumn rains commence. For autumn and winter growth a dressing should be applied during March or April. The effect of this application will carry on into the spring, and assist growth in August or September. Whether more frequent applications are justified is a matter which is being investigated at the present time.

Quantity of Application.—This must be governed by the natural capacity of the land to produce and by the financial resources of the farmer. The minimum dressing on most soils should be about 2 cwt. per acre, but larger dressings are recommended. It is noteworthy that nearly all the observed farms of highest production are

using from 4 cwt. to 6 cwt. per acre per annum of some form of phosphate, usually in two applications.

POTASH.

With the exception of a few comparatively limited areas, potash does not appear to give very striking results in New Zealand. This may be due to the fact that it has been used in too small amounts in the past, and its application should be the subject for trial by farmers. In addition to the ordinary manuring practised, small areas should be tested as indicated for lime. For trial purposes from 1 to 1½ cwt. of sulphate or muriate of potash should be used, or from 2 to 2½ cwt. of 30-per-cent. potash salts. The application should be continued for two or three years on the same plot.

NITROGEN.

Nitrogen, chiefly in the form of sulphate of ammonia, is being experimented with very largely at the present time. There is no doubt regarding the effect of nitrogen in increasing the growth of grass, the only point to be decided is to what extent its use is profitable. Farmers are advised to test it as an adjunct to the ordinary lime and phosphate manuring usually practised. There are very good indications that its use for the production of early spring, late autumn, and early winter grass is likely to be profitable. On those fields where it was used last season there is a noticeable improvement in the density and vigour of the grasses, especially the better species—rye-grass and cocksfoot. While there is still some doubt regarding the profitable use of nitrogen in the late spring and summer, farmers should not use it during these periods until further information is available. To increase grass during autumn, and to prolong growth into the winter, an application of from 1 cwt. to 2 cwt. should be made in March or April, along with the phosphate dressing already recommended. For early spring feed similar application about the middle of July appears to be as good as any, although much investigation into the time of application is needed before a definite recommendation can be made.

The point which should be clearly understood is that grass-growth resulting from the use of nitrogen must be consumed while in a nutritious and palatable stage. The rapid growth, if allowed to get too coarse, results in waste and subsequent difficulty in control of the pasture. At the presents stage farmers are advised not to use nitrogen on poor pastures which do not contain a fair proportion of the better grasses. The more rye-grass present the more likely is nitrogen manuring to be profitable.

GENERAL.

The limited extent of this article does not permit of more complete discussion of the many problems of manuring, but sufficient has been said to indicate the important part it plays in the management of grassland on intensive lines. It is clearly obvious from investigational work in different parts of the world that our knowledge is still very incomplete, and that New Zealand has its own particular problems which can only be solved by carefully conducted experimental work.

BOYS AND GIRLS' AGRICULTURAL CLUBS.

THE MOVEMENT IN SOUTHLAND, SEASON 1928–29.

J. E. DAVIES, Assistant Instructor in Agriculture, Fields Division, Gore.

THE boys and girls' agricultural-club movement was actively launched in Southland at a meeting held at Invercargill in February, 1928, when Mr. R. McGillivray (then Instructor in Agriculture for the district) presided over a gathering of representatives of the Education Board, Agriculture Department, Agricultural and Pastoral Association, Southland League, Farmers' Union, Reginald Mackinnon Trust, and school-teachers. A committee was formed of delegates from these bodies. Subsequent meetings were held at Wyndham, Winton, and Gore, and further support enlisted at those centres.

For the first season's work the committee decided to confine activities to a potato-growing competition, and the following standard rules were adopted: (1) Entries to close on 8th September; (2) competitors to be under sixteen years of age; (3) size of plots to be $\frac{1}{40}$ acre; (4) plots to be on competitors' home farms or elsewhere; (5) records covering the crop to be kept; (6) the variety of potato to be Arran Chief.

As in other parts of the Dominion, seed, manures, and instruction forms were supplied to competitors by the Department of Agriculture. The Reginald Mackinnon Trust assisted by supplying a championship medal and cash prizes for the three placed competitors in each centre.

The response in entries was satisfactory, 167 competitors representing twenty-three schools taking up the work. For the purpose of localizing interest, more efficient control, and as far as possible classification of soils, the schools were divided into three centres—Wyndham (9), Gore (9), and Winton (5). In addition, each school was asked to appoint a field supervisor to render immediate practical advice and to assist the teacher.

Four tons of good certified Arran Chief seed potatoes were procured from the Templeton district, Canterbury, and each competitor received 50 lb. The Department's standard manure, of which 14 lb. was allotted to each competitor, consisted of three parts superphosphate, two parts blood-and-bone, and one part 30 per cent. potash salts, the rate of application being 5 cwt. per acre. Any other manure could be used in addition, provided it was shown on the chart. Instruction forms and record charts were also issued covering the whole competition. For a set standard of comparison the potatoes were grown in 26-in. drills.

The returns and the high general standard of work achieved can be gleaned by the following summary:—

Number of schools entered	23
Number of schools completed	23
Number of competitors entered	167
Number of competitors completed (at final judging)	147
Number of plots destroyed by stock	2
Number of competitors left district, illness, &c.	18
Heaviest-yielding crop (tons)	31¼
Average weight of crops (tons)	16½
Average marks for cultivation (maximum 30)	25·2
Average marks for general appearance (maximum 10)	6·8
Average marks for quality (maximum 10)	7·2

Average marks for record chart (maximum 30)	13·5
Approximate total area of potatoes grown (acres)	4
Total yield (tons)	66
Yield of table and seed tubers (ton)	60
Approximate value of total produce grown by competitors	£450

It will be seen that selected seed with intense cultivation and careful attention on small areas were responsible for very fine average yields, thirty-nine competitors having grown crops of over 20 tons to the acre. An unsatisfactory point is the low average of 13·5 marks (out of 30) for record charts. This was due to the exceptionally high standard set by a few competitors.

Instruction and judging were done jointly by the writer and the Southland Education Board's Agricultural Instructor (Mr. T. Mathews). During the season two visits were made to each plot, and can be best described as junior field-days, teachers and supervisors accompanying the judges and competitors from plot to plot The first visit was made during February, and the second in May, when a standard area representative of each plot was weighed, from which the competitors were instructed in computing the tonnage per acre.

The following allowance of points was adopted, and proved satisfactory: 1 point per ton per acre in weight, with a maximum of 30 points for cultivation, 10 for general appearance, 10 for quality, and 30 for record charts.

Competitors were circularized with notes on potato-disease and its prevention; yet the majority of crops inspected were unsprayed, and blight was much in evidence. On the other hand, competitors who carefully sprayed their crops were highly rewarded, one of them gaining the championship, and others ranking as winners of their centres. The champion crop, grown by Dudley Tayles, records careful spraying, and on examination proved free from blight; it also showed specially vigorous growth, with haulms standing over 6 ft. high.

In two cases shortage of seed was recorded, and these plots were completed with locally grown Arran Chief potatoes. This gave added interest, and weighings in both cases proved the superiority, by several tons per acre, of certified seed.

Allotments for the championship and various prizes were made as follows, the place named referring to school in each case:—

Championship Medal (highest aggregate points in the competition):—
Dudley Tayles, East Gore: Yield, 31¼ tons; total points, 101¼.

Special Prizes:—
Highest points in cultivation and general appearance (maximum 40):
Desmond Hillis, Kennington, 40.
Highest points in record chart (maximum 30): Greer Miller, Gore, 30.

Group Prizes:—
Wyndham district—
Herbert Dunn, Wyndham, 97½ points, first.
Desmond Hillis, Kennington, 96 points, second.
James Pow, Edendale, 92 points, third.
Gore district—
Dudley Tayles, East Gore, 101¼ points, first.
Adrian Miller, Gore, 100¼ points, second.
Ralph Smith, Gore, 95¾ points, third.
Winton district—
Henry Middleton, Lora Gorge, 85¾ points, first.
Lex Gerrard, Winton, 84 points, second.
Stewart Irwin, Winton, 83 points, third.

Presentation of the championship medal and prizes to winners in each centre took place at the annual meeting of the organization held at Invercargill. As recorded in last month's *Journal*, the Stuart Wilson Cup for the season was won by Dudley Tayles.

The Southland Agricultural and Pastoral Association offered a number of prizes to club competitors in the winter show at Invercargill for exhibits of twelve potatoes, record chart, and an essay ("My Plot"). In this connection no less than 120 competitors strove for honours. The show has a distinct educative value in potato-selection, and a social aspect in the reunion of members. The wearing of club colours did much towards the union of members.

In addition to the prizes mentioned, donations have been received from the Education Board, the Farmers' Union, and several special prizes from private persons.

LIMESTONE SAMPLES ANALYSED.

In his annual report for 1928–29 the Chief Chemist, Department of Agriculture (Mr. B. C. Aston), gives the following brief description of some of the more useful samples of limestone submitted for analysis during the year:—

X/1277 was a soft white carbonate of lime from Mount Gladstone, Marlborough; though containing only 58·5 per cent. carbonate of lime, its soft texture would render it a useful source of lime for local application. X/1278, from Kamo, Auckland, was a white semicrystalline stone containing 96·5 per cent. carbonate of lime; this would be a very suitable stone for production of quicklime. Y/150 was a soft, easily ground shell deposit from Napier district; it contained 93 per cent. carbonate of lime. Y/153, from Waipara, Canterbury, was from a deposit occurring in the form of a fairly fine powder containing 66 per cent. carbonate of lime. Y/158–160, from the Hastings district Hawke's Bay, were calcareous sinters ranging from 79 to 86·4 per cent. carbonate of lime. Y/215 was a useful coarse shelly grit from Onehunga, Auckland, containing 80·1 per cent. carbonate of lime. Y/216, a hard shell limestone (80·5 per cent. carbonate) was from Hedgehope, Southland. Y/263–68, a series of six hard, semicrystalline limestones from Te Akau, Ngaruawahia, ranged from 80 to 97 per cent. in content of carbonate of lime; the higher-grade material would produce an excellent quicklime. Y/270 was a specimen of calcite (pure crystalline carbonate of lime) from Kopua, Hawke's Bay. Y/303–10 were a series of hard, semicrystalline limestones of high grade, from Tinui, Wairarapa; their carbonate-of-lime content varied from 89 per cent. to 97 per cent. Y/572 was a moderately hard stone from the Cricklewood locality, Canterbury; it contained 94·5 per cent. carbonate of lime. Y/583, from Albury, North Canterbury, was a hard limestone of excellent quality, containing 96·25 per cent. carbonate. Y/631 was a friable calcareous sinter from the Greymouth district; it was stated that this substance, which contained 89 per cent. carbonate of lime, could be dug out with a shovel, and it would therefore require no treatment beyond air-drying to make it suitable for application to the land; unfortunately, such deposits as this are usually of very limited extent. Y/503, from Wairoa, Hawke's Bay, was a shell limestone of high grade (91 per cent. carbonate). Y/851, from a shell deposit at Onewhero, Auckland, contained 85·5 per cent. carbonate of lime. Y/837 was a friable sandy limestone from Albury, South Canterbury, containing 77 per cent. carbonate of lime. Y/1083, from Hawke's Bay, was a shelly conglomerate, containing 91 per cent. carbonate of lime. Y/1087 was a friable white carbonate of lime, 97·5 per cent. pure, from Ngapaenga, South Auckland. Y/1107, from Martinborough, Wairarapa, was also a friable calcareous deposit, containing 76 per cent. carbonate of lime. Y/839, a calcareous sinter from Wainui beach, near Gisborne, contained 94 per cent. carbonate of lime.

SEASONAL NOTES.

THE FARM.

Pasture Considerations.

It is now time for those who have in mind the sowing-down of pastures in the autumn to be giving thought and attention to the matter.

Of the several causes which may lead to the poor establishment of pastures one of the most markedly harmful is insufficient preparation of the seed-bed. The seeds that are used in pasture establishment are relatively small, and this means that a fine, firm seed-bed is essential if one is to avoid burying a number of the seeds so deeply that they have but poor chance of pushing their shoots to the surface. Certain of the valuable species often used in permanent-pasture seed-mixtures have seeds below the average in size, and the establishment of these species is apt to fail if a rough, poorly-prepared seed-bed is depended upon. Hurried preparation is a most fruitful cause of poor seed-beds; usually the work of preparation should be commenced at least a few weeks ahead of the date it is proposed to sow the seed. Only by doing this can the desired mellow consolidated seed-bed be obtained.

There are at times weak features in the seed-mixtures used, and as a means towards avoiding mistakes in this respect the advice of the Department of Agriculture may be obtained. The necessity for obtaining the best possible results in the laying-down of pastures is now generally greater than it ever was, for top-dressing and altered management tend to give pastures greater permanency, so that the influence of a weakness which creeps in at the time of establishment is likely to be felt not merely for a season or so, but for many years.

At times, if convenient, it may be advantageous to allow thin old pastures to run to seed if the growth contains a reasonable sprinkling of the more valuable species which can be looked to for an improvement of the sole. Subsequently, when the seed has ripened on such pastures, drastic tripod harrowing is desirable to cover the seed, but this should not be done until autumn rains sufficient to establish the seedlings safely may reasonably be expected. Under favourable circumstances this method will assist considerably in giving a better sole. It is most likely to be useful if for some reason ploughing is either not desirable or not possible.

Grassland from which hay or ensilage has been saved in good time may often be top-dressed advantageously with phosphates immediately after the removal of the mown material. Superphosphate usually proves excellent for this purpose. On account of the rapid manner in which it acts if there is sufficient soil-moisture present, it soon stimulates a fresh growth which is particularly valuable because it becomes available when fresh grass-growth is apt to be scanty.

It is highly desirable not to allow young pastures to produce seed in their first year, and this is especially the case if they are desired to be of a permanent nature. If the stock available prove insufficient to prevent seeding, topping with a mower as has been described in previous months' notes should be carried out.

Application of Phosphates to Grassland.

Evidence is accumulating which points to the value of the application of phosphatic manures to grassland much earlier than has been the common practice in the past. For instance, provided the customary rains of that season occur, application of phosphates to grass in February or thereabouts may be expected quickly to give increased growth which is of particular

value. If a prolonged dry spell should follow the application of phosphatic manure at that time no material increase in growth could be expected from it while the dry conditions continued, but the influence of the phosphate would not on that account be lost, and would be exerted as soon as autumn rains provided adequate moisture in the soil. When a farmer proposes to apply phosphates to any one of his paddocks only once in a year he could well make it his practice to top-dress at least some of them in the summer or autumn, leaving the others to receive attention in the winter. By so dividing the top-dressing programme he will not only secure, under average circumstances, extra grass-growth in autumn and winter, but will also spread the labour incidental to top-dressing and distribute better through the year the outlay which he makes in manure.

Forage-crop Requirements.

It often proves useful during January to make a survey of the prospects in regard to an adequate supply of forage for the winter and early spring. This is so because by January one usually has not only a knowledge of what the current summer has provided in the way of hay or ensilage or chaff reserves, but also an indication of what success for the season is likely to attend root and other forage crops. Should the amount of forage in view for the coming winter and early spring seem likely to prove insufficient for the stocking that is planned, there is still time, if other circumstances such as labour are favourable, to increase the provision.

In the first place, one may resort to an early autumn or late summer-sown temporary pasture. This consists essentially of Italian or Western Wolths rye-grass, 20 lb., and red clover, 4 lb. or 5 lb., to the acre. This must be sown early to provide any certainty that it will yield a substantial supply of winter feed, and it can generally be depended upon for a heavy hay crop in the next hay season. When the land available will be required for a spring sowing, Algerian oats or Black Skinless barley—both at the rate of about 2½ bushels of seed to the acre—may suitably be used on it for winter or spring fodder. In many cases full benefit from temporary pastures or cereals sown for winter feed is not obtained because sowing is not done soon enough. This applies especially to the South Island.

If turnips and swedes have not been sown by the beginning of the New Year this work should be proceeded with as soon as possible, weather permitting. Where rainfall is good, sowing may continue to the end of January, but in most places, after the middle of January, it is safer to depend upon turnips rather than swedes, because turnips come on more quickly and are not so subject to the ravages of insect pests which may appear in summer and autumn. Hardy and Imperial Green Globe are suitable varieties of turnips for January sowing.

Chou moellier, which is of good value for providing winter fodder, may often be sown with success in January. It is of importance that this crop resists club-root attack. Success with all the above-mentioned crops when sown at the periods mentioned is at times largely dependent upon thorough preparatory cultivation of the land.

Potatoes.

Main crops of potatoes should be kept properly cultivated and free from weeds by frequent use of the hoe. No crop repays attention in this respect better than the potato, and especially is this the case if the season is a dry one. Moulding-up of the rows and spraying of the plants should be attended to. As spraying for Irish blight is to be looked upon more as a preventive than as a cure for the disease when established, the spraying should be done during early growth and repeated as required. Advice as to how to prepare efficient sprays is furnished on application to the Department of Agriculture. Certain of the ready-made preparations sold for use in treating potato-blight cannot be depended upon.

Lucerne.

In many districts lucerne may be sown with success up to February. A common error with this crop is to sow the seed, which is relatively small, too deeply; the depth of sowing commonly used with vegetable-seeds is suitable for lucerne. To be able to sow at such a depth uniformly a fine firm seed-bed is necessary. Young lucerne may require mowing towards the end of January. However, it is better not to mow too early, unless weeds are tending to rob the young lucerne-plants of light and nutriment. If conditions sufficiently moist to allow of superphosphate exerting its influence can be expected it is often good practice to top-dress a lucerne-field with superphosphate after it has been mown in midsummer. Superphosphate applied at this time will benefit little if anything except the lucerne, whereas manure applied in spring often benefits not so much the lucerne as invading plants, such as rye-grass, which are in competition with it.

Summer Saving of Soil-water.

In all but the rainiest parts, and more often than is usually thought to be the case, crop-yields are reduced solely because of inadequate supplies of soil-moisture. Some light on the matter may be obtained from the fact that during the growth of a good average crop of mangels about 2,000 tons of water passes from the soil through the leaves of an acre of the crop. Other crops have corresponding requirements. Hence, during summer, surface cultivation of the soil, which assists in checking loss of water from it by evaporation, is of prime importance in the management of those crops, such as mangels, potatoes, and swedes, which are sown in rows wide enough apart to allow of tillage between the rows. Usually this inter-row tillage should be carried out at frequent intervals until the crops have so developed as to have their leaves meeting across the rows. By so attending to intertillage the crop-raiser puts into practice what has been described as "watering with the hoe."

The loose surface layer of soil is known as a soil mulch, and in the case of pastures the place of the soil mulch may fittingly be taken by a plant mulch, if it can be arranged, as a means of checking undue drying-out of the soils upon which the pastures occur. To do this it is necessary not to have the pastures grazed too closely during the dry weather. The growth should be left long enough — consistent with proper grazing control — to have the soil covered as much as possible with leafage, which will act in a way similar to the soil mulch in checking escape of soil-moisture.

Another practical application of the same matter is the fact that land which has been ploughed out of old pasture and which is to be sown in crop in the autumn should be grubbed at intervals during the summer. This summer cultivation work, in relatively dry climates, will not only tend to weaken or destroy troublesome twitchy plants such as yarrow, brown-top, sorrel, creeping-fog, and couch-grass, but it will also conserve soil-moisture which may be specially useful to the autumn-sown crop.

Using of Summer Forage Crops.

A fairly common weakness of our farming is that the using of the special summer forage crops is not commenced early enough. In the first place, stock would often be better served in regard to their feed requirements were it remembered that on many farms, from about Christmas onwards for some weeks, while there is plenty of pasture growth available, this growth is usually not altogether suitable for wet stock—it has fallen off in digestibility and is ill-balanced as a ration for milk-production. At this stage great improvement in the ration would result by supplementing the pasture growth with such crops as young green lucerne cut just before it has reached the flowering stage, or with the second growth of an early-mown pasture paddock, or with early-sown quick-maturing soft turnips

which may not have reached their maximum yield but which nevertheless may be used advantageously at this period to maintain the milk-flow. Again, certain summer forage crops, such as lucerne, green millet, &c., are at times allowed to become so mature before being used that they are quite unsuited for milk-production. These crops are at their best for milk-production at a stage corresponding to that at which pastures are at their best for the same purpose—that is, before the woodiness and badly balanced supply of nutriment that comes with flowering has been developed.

—R. P. Connell, M.A., Fields Division, Palmerston North.

Water-supply for Stock.

A pure and wholesome water-supply is essential for all classes of live-stock. Animals can live much longer without solid food than without water, and an insufficiency of water in the body causes serious disturbances. The processes of mastication, digestion, absorption, and assimilation are hindered; the intestines are not properly flushed, and waste matter remains too long therein. In ruminants, particularly cattle, impaction results, with a consequent decrease in the yield of milk.

Under normal conditions animals consume a fairly uniform quantity of water for each pound of dry matter eaten. Depending on the succulence and composition of the food, so will the demand for water be regulated. Cows require from 3 to 5 gallons of water per day when dry, and about three times that amount when in full milk. Water is also essential in that it regulates the body-temperature; it is given off in the vapour from the lungs and also from the surface of the body.

Stagnant pools are a breeding-place for disease, and liable to surface contamination from the animals themselves. As a water-supply for stock generally these pools must be condemned. They are liable to harbour the eggs of internal parasites of stock, and if the pools are foul they may set up digestive disturbance in the animals.

Concrete watering-troughs for dairy cattle are gradually replacing wooden ones. Concrete troughs when erected should be provided with an outlet at the bottom for purposes of periodically draining and cleaning. The troughs should be conveniently situated in the various paddocks so that the cows may have more time to graze and ruminate. If the animals have to walk some distance for their water-supply they are not so contented, and do not give of their best in regard to milk-yield. This point is very essential, and attention to it will repay the extra cost in a very short time.

As the area around the trough is liable to become waterlogged and boggy in wet weather, it is very desirable to gravel this particular part. If this is done the tendency to foot troubles in the dairy herd is reduced.

—Live-stock Division.

THE ORCHARD.

Spraying Operations.

THE rapidly swelling fruit will now require close adherence to the spraying programme, in order to ensure that all portions are kept covered with protective spray material at all times. With crops rapidly approaching the picking-time any easing-up in spraying, although always a temptation, is exceedingly dangerous, with the result of the year's work at stake. A fresh flight of codlin-moth will be on the wing and laying from about the end of the first week in January, and as in some districts showers are frequent about this time the arsenate-of-lead sprays will require close attention.

Black-spot may be expected after periods of humid atmospheric conditions, and pome fruits will need another bordeaux or sulphur spray according to requirements. Precipitated sulphur will now be the dominant spray for apples, the harder commercial lime-sulphur having a tendency to produce burning and russeting.

Red mite usually becomes prevalent with the advent of warmer weather, and if not checked will at least seriously debilitate the trees, and very often check the development of the fruit and cause premature leaf-fall. Its presence is readily detected by the unthrifty, washed-out appearance of the foliage, and closer examination will disclose the presence of numbers of tiny, active, reddish insects mostly on the undersides of the leaves and on the fruit, where the tiny spherical bright-red eggs are laid in the calyx cavity. Control lies in spraying with oil emulsion, 1–100, plus Black Leaf 40, 1–800, thoroughly wetting the undersides of the leaves and fruit.

Quinces should not be omitted when using fungicides, the application of lime-sulphur, or bordeaux 3–4–50, being necessary for the control of fabraea scald in addition to the lead for codlin-moth and leech or pear-slug.

Sulphur sprays should be continued on stone-fruits up to about a fortnight prior to picking.

Thinning.

The main thinning should now be well advanced, and a fair estimate can be made of the amount of fruit left to develop. If the development of the early-ripening varieties has been retarded through unfavourable conditions due to dry weather or insufficient thinning it will be found beneficial to thin still further, so as to encourage development in the short time that remains before picking commences, and reduce the quantity of what would otherwise be undersized fruit. Late flowering in Jonathans is sometimes responsible for more fruit than is desirable being left, and a second thinning can be done with advantage.

Budding.

From early in January onwards budding may be proceeded with, either on young stocks grown for the purpose or on trees where grafts have missed. Firm current season's wood is more satisfactory to bud into, but this cannot always be found in the desired position and it becomes necessary to resort to older wood, when, provided that the tree is vigorous and the bark is in good condition, satisfactory results can be obtained. However, fresh, hard, young growth should be selected if possible.

T or shield budding is almost universally adopted. One of the essentials is to have a thoroughly sharp smooth edge on the knife. It will be found that, in taking the bud, commencing the cut on the lower side and working upwards towards the tip of the shoot has some advantages over the reverse procedure. With stocks in good condition — that is, when the bark is lifting readily—when the perpendicular cut in the stock reaches the transverse cut previously made, a slight sideways twist with the point of the knife will be all that is necessary to raise the bark sufficiently to permit the insertion of the bud. Having been cut from the bottom, that portion of the bud will be stiff enough to be pushed down into position, and only sufficient bark to accommodate the bud will have been displaced. If possible, opening the bark for the full length of the cut, either with the blade or the handle of the knife, should be avoided, as the wound will extend further than is necessary and the injury to the delicate plant-tissue will retard the union.

Probably the two most common causes of failure, apart from unfavourable conditions in the stock, are slow working, causing the exposed surface

to dry, or cutting the bud too thick. The cut should be only deep enough to include the bud and a trace of the underlying wood. Any excess of wood should be removed, commencing from above the bud and peeling downwards. This will leave just sufficient wood in the eye to give rise to new growth. If the removal of the wood is commenced from below the bud the wood in the eye may pull out, leaving only a hollow shell of bark that will not start into growth. After inserting the bud any portion projecting beyond the top cut should be removed, and the whole firmly tied with raffia or other suitable material to bring the parts into close contact and exclude the air and moisture.

Cultivation and Cover-crops.

The continuation of cultivation will not be practicable for much longer, and consideration of cover-crops should receive attention. For this purpose blue lupins are generally sown from November onwards, according to weather conditions and locality. Sowing for grazing purposes can be proceeded with, and a mixture, sown at the rate of about 15 lb. per acre, of Western Wolths or Italian rye-grass and prairie-grass should provide grazing for hoggets during the winter months as well as suppressing weeds, making a better sod for spring ploughing, and increasing the humus-content of the soil.

Citrus-culture.

The heavy frosts which were recently experienced in some districts will necessitate a certain amount of attention to trees to correct the clustered condition of the young growth consequent upon the destruction of the apical buds. Only such shoots as are required for terminal extension should be retained, and the remainder removed to ensure satisfactory development in the desired positions. Failure to limit the number of growing-points not only produces undesirable crowding, but frequently results in the tree making very little progress for two or three seasons until the most favourably situated shoot asserts itself and definitely takes a lead.

Young freshly planted trees should be gone over to remove any shoots starting from low down on the stem and anything which may develop into a secondary stem. For future handling it is important that the trees should have only one well-defined stem, of sufficient height to place the first fork well above the ground, and if the shoots are rubbed out before they harden the liability to infection by wound parasites is greatly reduced. The successful treatment of collar-rot and other bark-diseases is rendered much more difficult where crutches low down afford lodgment for disease spores, soil particles, and moisture.

Young borers will now be active, and should be treated before their operations become extensive. They may be located by their castings; small affected twigs should be removed and burned, and larger ones treated by injecting benzine into the holes and plugging with soap or putty.

Fruit should now be reaching the setting stage, and an application of a quick-acting nitrogenous manure, preferably during showery weather, is generally beneficial in carrying over the critical period.

Repeat the application of bordeaux where necessary, in order to maintain a cover against grey scab and verrucosis on young fruit or foliage. For insect control oil, 1–160, or Black Leaf 40, 1–800, may be used. When using Black Leaf 40 alone, soap at about 3 lb. to 100 gallons should be added to improve the spread and adhesiveness.

—G. H. McIndoe, Orchard Instructor, Gisborne.

POULTRY-KEEPING.

Precautions against Vermin.

As the time has now arrived when hot weather may be expected, it is important that a keen eye should be kept for the presence of vermin. This is essentially the best time to take steps for the destruction of these parasites, for it is during hot weather that they are apt to show up and multiply at an alarming rate. The best method of dealing with vermin is to prevent them from making their appearance. This implies strict attention to cleanliness, the provision of good dusting-places, periodical sprayings of the houses with strong disinfectant, and the application of Black Leaf 40 to the perches.

Keeping the nest-boxes free from broody hens is another matter which must not be overlooked. To allow birds to sit on the nests day after day not only encourages insect pests, but it also means a loss in eggs and reduced profits. The houses should be visited nightly, and any birds found on the nests should be removed to the broody-coop. The common mistake should not be made of starving the broody hen. If eggs are to be produced in the shortest space of time, ample food of the best quality should be provided.

Green Feed.

Every effort should be made to provide an abundant supply of green material for autumn and winter use. Green feed serves a threefold purpose: it not only keeps the fowls in good health and gives the yolk of eggs the desired rich colour, but it materially assists in reducing the grain bill, and thereby makes for economical production. It cannot be too strongly emphasized that for young stock to make the best growth they must never receive a set-back, and one of the worst checks to healthy development is lack of green stuff during the growing-stage. Silver-beet is an excellent thing to grow for poultry, and is a heavy cropper. Any of the cabbage family, including rape, or, alternatively, mangels, carrots, and green oats, may be grown to advantage.

Culling.

Many requests have been received from poultry-keepers for the Poultry Instructors to pay them visits early in the New Year, for the purpose of giving advice and assistance in regard to culling their flocks. This is not such a simple matter to carry out as it may appear to the inexperienced. In successful poultry-keeping there is a time for everything, but the present is certainly not the time for the general culling of a flock to be carried out. Such culling should have been done last March, or be left until the same month next year. It is only towards the end of the laying-season—in other words, just before the moulting process takes place—that even the keenest judges of form can distinguish between the bird that will be profitable and the one which will not.

While advising that the main work of culling should be deferred until autumn, it must not be inferred that the weeding-out of undesirable stock should be left entirely to that period of the year, as odd birds may, to the advantage of the plant, be weeded out at all periods of the year. Culling may even commence during the first months of maturity, for it is useless to expect a weak-constitutioned bird to turn out profitable; again, there are always freaks and throwbacks from the best matings which will never develop into satisfactory stock.

Though this is the case, it is almost impossible at this period of the year to satisfactorily cull a laying flock. The only guide to successful culling is the appearance of the birds, except, of course, where individual egg records are kept by means of trap-nests, &c. Usually the bird well above the

average weight of the breed is the drone, but even in this case it may be a mistake to discard her, as the overweight may merely be the result of an enforced rest. Then, again, at the present time a number of birds will be taking a rest and will have signs indicating poor egg-capacity, such as shabby appearance, worn plumage, and more or less shrinking of the comb and the abdominal region, but in these cases it may be merely a prelude to a heavy laying-period in the late summer and autumn. It can therefore be seen how difficult it is to distinguish between the two classes of birds—the poor layer, and the heavy layer which has just experienced an exhausting laying-period and is preparing for further egg-production.

It may generally be taken as a good guide that the thinnest birds, showing a rough and shabby appearance, including bare heads, from now on to moulting-time are the heaviest layers in the flock. Unfortunately, many poultry-keepers do not realize this, and as a result a keen student of laying form visiting the average auction-mart cannot fail to see some of the best laying-types of birds in the country being marketed long before they have finished their best season of production, this being due solely to their rough appearance, and to ignorance on the part of their owners in not knowing that the appearance of the birds is entirely due to heavy egg-production.

I would again emphasize that it is a mistake to cull at any time birds that give indications of laying-power, such as the absence of any signs of moulting, the presence of a red comb, a fullness of the abdomen, and an active businesslike appearance, even if they do have a shabby appearance.

The Pullet for Winter Production.

A correspondent has asked my advice as to the feasibility of inducing his birds to moult during the early autumn, with the idea of their laying better during the winter months. In my opinion the proposal has nothing whatever to recommend it. This is one of the many things in connection with poultry which sound well theoretically, but which seldom or never prove of value when put to a practical test. It is an easy matter to induce a false moult, and, provided the birds are well fed and managed after moulting, they will come into profit at a time when the egg-market commences to rise. Usually, however, they will moult again at the ordinary season and cease to lay. In the management of laying-birds experience shows that the less one interferes with the natural course of things the better. For winter egg-production there can be no doubt that the pullet is the most desirable bird; and if a maximum of profit is to be secured the pullet should be kept going from the time she reaches maturity, forcing every egg out of her until her period is completed, irrespective of season and the price of eggs. Naturally this would not apply in the case of a bird intended for future breeding purposes.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Returning Swarms to Parent Colonies.

SWARMS in January are of little value except as increase for next season, and should be returned to the hives whence they originated if these can be traced. It is a good plan to kill the old queen in the swarm when returning it, at the same time destroying all but two queen-cells in the parent colony. If the colony is cramped an extra super may be given, and with this inducement the colony will usually settle down at once to work.

After-swarms should always be returned to the parent hive. They are easily disposed of even if the beekeeper does not know whence they came. If they are shaken through an excluder into an empty super the virgin

queen or queens can easily be picked out as they attempt to force their way through, and once these are removed the bees will return to their old home. The young queens can then be used to replace poor queens in the apiary. It is an excellent plan to have one or two queen-cages always on hand. The young queens can each be confined in a separate cage, and when the queen to be destroyed is removed the closed cage containing the virgin can be placed on top of the frames and left there for twenty-four hours, during which time she will be fed by the bees in the hive. At the end of twenty-four hours she can be released and allowed to run down into the frame, when she will be accepted by the bees.

Ventilation.

The matter of ventilating the hives should by now be receiving every attention. Every means should be used to ensure the bees having an abundance of fresh air by day and night. All weeds and other obstructions should be removed from the front of the hives, and the entrances enlarged as much as possible. In extreme cases the hive-bodies should be raised from the bottom-boards by means of small blocks of wood. On no account should the bees be allowed to cluster outside the hives, and wherever they show a tendency to excessive fanning steps should be at once taken to increase the supply of fresh air to the colony.

Handling of Supers.

One of the necessities of a well-regulated apiary is an abundance of supers when the honey-flow is in full swing. Every inducement should be given the bees during the often brief season to gather in every available drop of nectar. No beekeeper with business acumen will allow his bees to loaf or cluster outside the hives for lack of storage room. It is well when adding additional supers to place them between the brood-chamber and the first super, or at least to raise a few frames of honey from the first super into the second when adding the latter.

It should, be understood however, that supering must not be overdone and the bees disheartened by being given too much work at one time. On no account add a second super until the bees are well at work on the first, and in cases where the colonies are only building up well at the beginning of the honey-flow — that is, where a poor colony has been requeened and the new queen's brood has not yet hatched—it is an excellent plan to tier up with half-stories, when it is doubtful if any return at all would have been obtained by the use of full-depth supers.

Use of Queen-excluders

January is the month when queen-excluders are of most use to the beekeeper, especially in South Island districts. Whatever their disadvantage may be in some localities, in the South they have proved their efficacy in enabling the apiarist to finish extracting before the hot weather goes, without the destruction of any brood whatever. They should never be used for general purposes until the main honey-flow is in full swing. By that time the bees are used to working in the supers, and with nectar in abundance to be had all around them they will work cheerfully right through the hive, passing through the holes in the excluders as if no obstruction existed.

The best method of using the excluders is as follows: All sealed brood should be raised above the excluder, and the queen confined below on drawn-out combs. The brood above the excluder should be watched for a few days in case any eggs have been elevated, as the bees will sometimes attempt to raise queen-cells above the excluder. If this happens, the queen-cells should be destroyed, as the queens which will emerge from them will not

be able to pass through the excluders to get mated, and will in time develop into drone-layers. By providing the queen with plenty of empty combs she will be able to continue laying at a sufficient rate to keep up a supply of workers, and as the brood hatches out in the upper stories the cells will be at once filled up with honey.

Queen-excluders are often condemned as being productive of overswarming, but in many localities swarming ceases automatically as soon as the main honey-flow commences, and if the queen is allowed plenty of room in the brood-chamber, and the brood in the supers is carefully watched for the production of queen-cells, very little harm can come from the use of excluders, while the immense advantage of being able to extract combs entirely free of brood is worth a great deal to the apiarist at his busiest season.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

The Tobacco Crop.

THE early tobacco crop is now approaching maturity, and preparations for the harvest should receive close attention, as the efficient and economical curing of a crop demands very careful organization to carry it through successfully with the usual facilities available. The chief limiting factor in tobacco-growing is the shed accommodation for curing the leaf. This is generally rather small for the quantity to be treated, and for this reason manipulation must be carefully studied to use it to best advantage. A good supply of curing-sticks will be required—about 700 per acre for air-curing on the stalks. These sticks should be 4 ft. 3 in. long and sufficiently strong for the purpose. Too often a number of weak sticks are used; these bend with the weight, and being thus shortened slip from the tier-poles, damage the leaf, and give unnecessary work.

The usual shed accommodation is quite suitable for curing the early crop, but for later crops, and especially in districts with a humid climate, a building that is sufficiently close to exclude fogs and low temperatures when necessary is required. Where corrugated-iron sheds are used it is important that sufficient ventilation should be available in the gables and roof of the building. Buildings with a shingle roof in poor condition should receive attention if they are to be used for curing tobacco-leaf, otherwise drips in wet weather will do great damage and make good work impossible. It is important that the sheds should be thoroughly clean and dry, and free from any decaying vegetable matter, otherwise moulds are sure to occur. Under suitable conditions that are occasionally unavoidable moulds will infect the leaf with disease, which is the chief trouble to be guarded against in this operation. Sufficient tier-poles and posts on which to hang the sticks of tobacco will be required, and they should be strongly bolted into position As this scaffolding has often to carry the weight of men who are filling the shed the timbers should be carefully inspected to see they are amply strong for the purpose, and so avoid what may easily be a very serious accident. About 14,000 cubic feet of shed room is required to cure an acre's produce of leaf on the stalks, and about half that space if the single-leaf system is adopted.

Perhaps the most important part of the necessary equipment for the successful handling of tobacco-leaf is a thoroughly clean, warm, dry room in which to bulk it down after curing. Too often well-cured leaf is left hanging in the sheds until the humid cold weather of late autumn depreciates its colour, texture, aroma, and flavour, and even moulds become established. Most important is it that leaf should be bulked down as soon

as it is properly cured, and this should be done in such a room as described, as only under such conditions will its quality be maintained, and indeed improved. Such a room should have a well-ceiled roof; bare corrugated iron is unsuitable, as it collects moisture in cold weather. This practice not only gives leaf of a better quality, but by economizing the space in the curing-shed permits of a greater quantity being handled.

Tomatoes.

Towards the end of January the bulk of the outside tomato crop commences to mature, and early in February it is well established on the market. In view of this fact the grower with a crop under glass should now give it close attention to make the most of the market opportunities before the outdoor crop arrives. The progress of the maturing crop may be assisted by feeding fortnightly with liquid fertilizers, and careful attention should be given to watering and ventilation, to keep the plants in general good health and avoid an attack of leaf-mould or other diseases which check the development of the fruit.

The outside crop will now require careful supervision, so as to note the first signs of any disease which may attack the crop, and to promptly deal with it. As the crop ripens and picking commences, moderate dressings of fertilizers, including nitrates, may be given to help development. Sometimes this is given too generously, which is very unwise, as it is not only a financial waste but is frequently harmful by predisposing the crop to disease.

There are many encouraging signs of improvement in the packing and marketing of this important crop. There are still a few, however, who pack fruit of mixed stages of maturity, and sometimes even immature fruit. Such a practice makes the general retail price high, and further discourages sales by giving the consumers who buy it a distaste for the fruit at the beginning of the season, as immature fruit of this class never develops the full flavour and appearance that makes it really attractive. It is to the grower's interest not merely to sell his crop, but to make the goods popular and create a good demand by delivering the fruit so that it may be sold in first-class condition. Trade in these goods would no doubt greatly increase if the small section of growers who pack immature fruit and poor types were to improve their practice. Coloured fruit and mature fruit of good quality should be packed in separate boxes and labelled accordingly; other kinds should be discarded.

Small-fruits.

Among the small-fruit crops attention should be given to the plants as soon as the harvest is over. The fruiting-canes of raspberries and loganberries should then be cut at the surface of the ground and carried out and burnt. Strawberry-beds should have the longest straw removed, be cleaned of weeds and runners, and given a light cultivation to encourage autumn growth. Gooseberries and currants, white and red, may be summer pruned by removing the stronger young growth that may be crowding the centre of the plants; some even recommend that the old fruiting-wood in black currants should be cut out now. If this pruning is followed up with such spraying as may be necessary, the plantation should have clean, ripe, strong growth for next season's cropping.

The Market-garden.

In districts subject to late blight the potato crop should now be sprayed at intervals of two to three weeks. Select sets of early potatoes from the best roots only, and while ripening them see they are not exposed at night in fine weather to the attack of the potato-moth.

The planting of the winter-crops of savoy, cauliflower, broccoli, leeks, and celery should now be completed. In dry districts celery should be

planted in the usual trenches and kept well watered, but in more humid localities and on moist rich soil it may be planted in shallow drills, and later blanched by earthing up or by means of 12-in. boards placed along each side of the rows. When these winter crops are established a small dressing of nitrate of soda may be given to keep them moving.

The leading growth of marrows and pumpkins should have the point removed to encourage the formation of fruiting laterals, also the growth thinned generally to avoid crowding. Marrows are best cut as soon as they are big enough; the larger sizes are not in good demand. Remember plants of this class like plenty of water on a well-drained soil.

Rhubarb and asparagus beds now require a good dressing of manure and fertilizers to encourage a vigorous growth, in order to put them in strong condition for next season's cropping. From now on the cutting and pulling of sticks should cease, and the plants be allowed to make their natural growth.

For late crops sow now peas of a variety known as "early," kidney beans, lettuce to mature without transplanting, turnips, spinach, turnip-rooted beet, and shorthorn carrots.

The Homestead Garden and Shelter-belts.

Where new gardens are being made the final preparation of the land should now be done; especially should it be cleaned of twitch and bad weeds. The cultivation of the soil and grading of the surface should be done in good time, so that the ground may settle and consolidate before the surface is raked smooth and sown with grass-seeds early in March.

The planting season for hard-wooded plants will commence in the month of May. In preparation one's requirements of this kind should now be carefully studied, as successful planting depends on thoughtful planning more than on any other factor. In local public gardens, nurseries, and the locality generally one may study plants of all kinds that may be desirable for any purpose, shelter or ornament, for flowers or fruit, trees, shrubs, and climbing-vines. We have one of the best climates and soils for production of this class, and the wonder is we do not take more advantage of our great opportunities of this kind.

A New Bird-scare.

Reports from America state it has been proved that birds have a particular dislike for blue material. Seed-beds may be effectively protected by "kite-tails" made from bright blue paper, and fruit-trees and shrubs may have the crop preserved by tying in strips of cloth or paper at intervals. The battle with the birds is often a strenuous fight, but it will be an easy success if one can protect the strawberry beds with flags of bright-blue paper in cleft sticks.

—W. C. Hyde, Horticulturist, Wellington.

Control of Diamond-backed Moth.—As is well known to farmers, the larvæ of this moth are particularly destructive in cruciferous crops grown throughout the country. With a view to biological control it has been deemed essential by the Plant Research Station at Palmerston North to ascertain the different species of parasites and hyper-parasites (if any) already here. This phase of the work is now well advanced, and specimens of the parasites obtained have been forwarded to the Imperial Bureau of Entomology, London, for specific identification. The life-history of the moth is also being studied.

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR NOVEMBER, 1929.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Clara	Truby King, Stratford	1 342	240·5	365	10,678·3	616·54
Totara Bank Lady Betty	W. D. Dron, Nelson	1 364	240·5	365	10,630·6	594·38
Claribel of Oaklands	Truby King, Stratford	1 352	240·5	365	9,844·6	536·90
Admore Flirt	R. A. Lewis, Dargaville	1 341	240·5	365	9,781·4	508·99
Orange Vale Wireless	Estate of W. J. Hall and Son, Matatoki	2 21	242·6	365	9,200·7	474·64
Oak Farm Sylvian	G. B. Knowles, Tariki	2 10	241·5	365	7,781·3	472·56
Oak Farm Joan	G. B. Knowles, Tariki	2 5	241·0	360	8,144·2	459·54
Ku Ku Elegance	R. L. Horn, Ohau	2 8	241·3	365	8,190·1	457·48
Tauwhare Doon	Dr. C. G. Aickin, Auckland	2 4	240·9	365	8,623·5	449·16
Tauwhare Pansy	Dr. C. G. Aickin, Auckland	1 347	240·5	365	7,890·5	445·91
Oak Farm Pal o' Mine	G. B. Knowles, Tariki	1 356	240·5	365	7,950·1	443·35
Dellside Heatherbell	A. N. Griffin, Richmond	1 279	240·5	365	7,469·9	434·68
Tauwhare Aster Queen	Dr. C. G. Aikin, Auckland	1 343	240·5	365	8,087·0	431·06
Oak Farm Rosary	G. B. Knowles, Tariki	1 314	240·5	365	8,198·2	421·51
Bluebird's Lassie	H. Hyland, Hastings	2 1	240·6	365	7,775·0	415·16
Penzance Lilac	F. P. King, Cambridge	2 68	247·3	340	7,917·5	413·96
Ku Ku Gleam	R. L. Horn, Ohau	2 30	243·5	343	8,265·5	409·14
Jerseydale Stylish	John Pettigrew, Pihama	2 17	242·2	365	7,779·7	388·28
Royton Eileen	F. B. Starky, Opotiki	1 363	240·5	365	6,341·8	387·19
Brookley Melba	W. Johnson, Ngaere	1 354	240·5	313	6,523·8	353·19
Royton Effie	Mrs. I. W. Spiers, Levin	2 5	241·0	365	7,008·8	343·20
Awapuni Winnie	W. Devine, Palmerston N.	1 346	240·5	292	5,576·6	311·13
Arthingworth Midgie	E. Smallbone, Richmond	1 345	240·5	336	6,283·7	302·58
Elpin Grange Lady Astor	E. S. Walker, Stratford	1 306	240·5	325	5,433·4	302·35
Brookley Poppy	E. W. Jacobs, Horotiu	2 47	245·2	304	4,983·6	295·73
Viola's Golden Mirnee	Mrs. A. Jagger, Papakura	2 12	241·7	313	5,849·4	295·35
Marshlands Dark Maiden	W. Archer, Invercargill	2 17	242·2	345	4,561·2	267·14
Bethune Andre	A. S. W. Hazard, Waimate North	2 22	242·7	226	5,470·0	265·29
Burrwood Victress	J. B. Tonar and Son, Northcote	1 327	240·5	353	5,146·3	263·45
Senior Two-year-old.						
Promise's Lady	Mrs. L. A. Turner, Riverlea	2 325	273·0	353	10,486·3	578·37
Wairua Frenzy	A. L. Dermer, Feilding	2 342	274·7	365	10,389·0	558·32
Wairua Frivolity	A. L. Dermer, Feilding	2 337	274·2	365	9,638·9	522·83
Wairua Camelia	A. L. Dermer, Feilding	2 358	276·3	365	9,244·3	521·07
Clendon Pretty Mary	H. Peoples, Drury	2 363	276·8	365	7,271·3	520·50
Countess Clematis	R. Fleming, Waimana	2 359	276·4	365	10,170·8	517·15
Cowslip of Stonycroft	S. Unwin, Winchester	2 269	267·4	365	7,461·8	454·55
Bethune Dorothy	A. S. W. Hazard, Waimate North	2 306	271·1	365	7,543·9	432·38
Ratavale Frisky Maid	Mrs. I. W. Spiers, Levin	2 111	251·6	343	6,933·4	385·90
Three-year-old.						
Wellfield Skylark	W. J. Murray, Otakiri	3 23	279·3	365	10,996·2	779·95
Wellfield Queenie	W. J. Murray, Otakiri	3 19	278·9	365	11,130·7	657·73
Huia Joyful	H. G. Lever, Tauranga	3 320	309·0	365	10,599·4	554·32

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued*					
Three-year-old—contd.		Yrs. dys.	lb.		lb.	lb.
Mauriaena Fleur-de-lys	T. and A. Smith, Otorohanga	3 336	310·6	365	10,072·4	544·03
Ratavale Ideal ..	Mrs. I. W. Spiers, Levin ..	3 82	285·2	361	10,298·4	538·60
Waiora Mayflower ..	A. E. Peppercorn, Cambridge	3 32	280·2	365	8,301·6	505·22
Wairua Caramel ..	A. L. Dermer, Feilding ..	3 40	281·0	365	7,355·7	488·45
Clifton Some Eileen ..	Mrs. A. Jagger, Papakura ..	3 80	285·0	316	7,533·1	453·48
Arthingworth Josephine	E. Smallbone, Richmond ..	3 322	309·2	365	8,740·9	409·02
Four-year-old.						
Wellfield Legacy ..	W. J. Murray, Otakiri ..	4 286	342·1	365	11,388·5	693·29
Woodnook Dawn ..	J. A. Moffat, Turiwiri ..	4 7	314·2	365	11,139·2	617·41
Ivondale Marigold ..	Dr. C. G. Aickin, Auckland	4 351	348·6	365	10,342·0	561·82
Maid's Joy ..	H. G. Lever, Tauranga ..	4 351	348·6	365	10,820·1	550·46
Eileen's Countess ..	R. Fleming, Waimana ..	4 316	345·1	365	9,109·3	526·41
Tyrone Girl ..	R. J. Johnston, Runciman	4 278	341·3	363	7,889·1	502·56
Manor Hussy's Island Queen	J. B. Tonar and Son, Northcote	4 209	334·4	305	7,624·0	417·81
Beata of Aria ..	M. V. Reeve-Smith, Aria ..	4 360	349·5	288	7,435·6	402·42
Belvedere Radianta ..	R. W. Ferris, Tokomaru ..	4 363	349·8	327	6,998·1	363·78
Mature.						
Wairua Carmania ..	A. L. Dermer, Feilding ..	5 315	350·0	365	10,387·2	626·36
Earlston Lily ..	Chisholm Bros., Hunterville	6 16	350·0	365	10,156·1	598·30
Wairua Frauline ..	A. L. Dermer, Feilding ..	5 326	350·0	365	10,289·8	588·19
Vixen's Golden Ray	R. E. Clements, Awakino Pt.	6 358	350·0	365	10,649·3	581·36
Rockview Princess ..	W. H. Fitness, Rehia ..	6 273	350·0	365	9,382·1	565·77
Wairua Frano ..	A. L. Dermer, Feilding ..	7 310	350·0	365	10,485·0	563·78
Mere Whitu ..	F. S. McRae, Palmerston N.	5 329	350·0	355	10,423·0	562·64
Orielton Heather Bell	W. Archer, Waikiwi ..	11 79	350·0	364	10,046·7	541·76
Fair View Meadow ..	A. Hazelton, Waihou ..	7 364	350·0	344	10,101·6	540·05
Seacliff Marigold ..	H. Robson, Hamilton ..	5 31	350·0	330	8,916·1	539·54
Beresford Belle ..	T. Brownlee, Pukekohe ..	6 29	350·0	266	8,629·8	532·86
Fawn Princess ..	Truby King, Stratford ..	7 344	350·0	305	10,233·9	516·78
Wairua Sprite ..	A. L. Dermer, Feilding ..	5 360	350·0	310	9,376·2	512·42
Earlston Peggy ..	Chisholm Bros., Hunterville	6 25	350·0	340	9,262·0	508·53
Beanbah Pet ..	Mrs. A. Jagger, Papakura ..	5 330	350·0	338	8,334·9	491·80
Roslyn Sweet Love ..	Mrs. A. Jagger, Papakura ..	9 13	350·0	332	8,713·4	489·77
Arden Viola's Bess ..	R. W. Ferris, Tokomaru ..	5 292	350·0	365	7,439·2	467·13
Jersey Meadows Princess	Mrs. I. W. Spiers, Levin ..	6 18	350·0	338	8,751·5	464·27
Belvedere Radiance ..	R. W. Ferris, Tokomaru ..	6 338	350·0	334	9,339·9	463·46
Silvery Sea.. ..	H. G. Lever, Tauranga ..	6 301	350·0	365	7,908·7	462·35
Rosemont Lady's Maid	Mrs. V. I. Gunson, Tauraroa	5 22	350·0	365	9,634·0	460·05
Rosemont Sybil ..	Mrs. V. I. Gunson, Tauraroa	5 22	350·0	344	8,283·4	457·49
Ryelands Goldon Sunrise	A. S. W. Hazard, Waimate North	5 1	350·0	332	8,150·9	440·83
Middlewood Twinkle	J. A. Cornfoot, Feilding ..	5 29	350·0	305	7,707·7	424·47
Rosedale Lilian ..	R. J. Johnston, Runciman	5 85	350·0	306	7,645·2	411·70
Rockview Ruby ..	W. H. Fitness, Rehia ..	8 30	350·0	287	7,107·7	400·35
Ebors Champagne ..	R. J. Wilson, Putaruru ..	5 323	350·0	305	7,321·6	381·42
	FRIESIANS.					
Senior Two-year-old.						
Rosevale Colantha Korndyke	H. W. Birch, Roxburgh ..	2 306	271·1	347	9,900·4	342·39

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS—*continued.*	Yrs. dys.	lb.		lb.	lb.
Senior Three-year-old.						
Omaha Cordyline Vola Paxton	A. Migounoff, Matakana ..	3 363	313·3	168	8,791·7	327·63
Junior Four-year-old.						
Mahoe Netherland Astelia	R. A. Wilson, Bulls ..	4 6	314·1	336	12,470·6	470·00
Senior Four-year-old.						
Livingstone Lady Wakalona*	W. J. Eames, Hunterville ..	4 242	337·7	272	15,402·9	614·19
Mature.						
Ivy Netherland Pietertje	T. O. Hodgson Estate, Tamahere	5 58	350·0	345	17,932·4	593·33
	MILKING SHORTHORNS.					
Junior Two-year-old.						
Glenthorpe Lady 3rd	Black Bros., Whakatane ..	2 56	246·1	253	10,098·5	417·52
Mature.						
Riverdale Florrie 3rd	T. W. Wardlaw, Waimana	6 267	350·0	365	16,856·2	681·09
Stockton, Molly ..	W. E. G. Holland, Edgecumbe	7 12	350·0	335	11,267·1	424·10
Naumai Melba ..	R. F. Baguley, Naumai ..	6 173	350·0	344	9,573·0	390·38
	AYRSHIRES.					
Three-year-old.						
Fair Lass of Greenbank	W. Moore, Masterton ..	3 267	303·7	365	16,110·4	639·85
Greenfields Marilyn ..	C. E. C. Webb, Levin ..	3 18	278·8	346	7,701·5	301·46
Mature.						
Elims Rowena ..	A. R. Claridge, Toko ..	9 297	350·0	365	11,653·9	517·49
	RED POLLS.					
Two-year-old.						
Glen Eden Queenie ..	J. G. Donaldson, Stirling ..	2 105	251·0	365	7,501·9	308·45
Three-year-old.						
Glen Eden Tablemaid	J. G. Donaldson, Stirling ..	3 8	277·8	365	7,282·9	308·28
Mature.						
Wayward 6th B No. 1	G. S. Young, West Plains ..	6 349	350·0	365	11,404·8	536·50

Second-class Certificates.

Jerseys.

Junior Two-year-old.						
Flaxmoor Twilight ..	M. A. Jennings, Mauriceville	2 16	242·1	365	7,574·4	415·57
Senior Two-year-old.						
Jerseydale Colleen ..	John Pettigrew, Pihama ..	2 300	270·5	365	7,856·3	396·36
Rosedale Fancy Fox	E. J. Adams, Puni ..	2 359	276·4	365	6,699·2	314·83
Four-year-old.						
Rewa San Fan ..	R. W. Ferris, Tokomaru ..	4 285	342·0	365	7,493·6	411·19

THE DEER PEST: ACTION BY STATE FOREST SERVICE.

THE annual report of the Director of Forestry (Mr. E. Phillips Turner) for 1928–29 refers to the deer pest as follows:—

The payment of a bounty of 2s. per tail has been continued during the year. In Nelson Region 2,564 tails were received; in Southland, 3,370; Canterbury-Otago, 3,837; Westland, 560. Fifty-three red deer were also destroyed in Golden Downs Plantation, Nelson; 41 were shot in the Rotorua plantations, and 70 on Stewart Island: a total for the year of 10,495.

The establishment of "salt licks" has not yet proved successful in indigenous forests, but there is definite evidence that deer are attracted to the licks in the exotic plantations.

Deer-destruction is now being carried out systematically by parties under Forest officers in all infested areas. Assistance is being given by exporters in testing the world's markets for the utilization of hides, horns, and venison, with a view to enhancing the commercial value of the pest and in order that a reduction in numbers may be achieved at as low a cost as possible.

An official party was engaged in the Lilburn Valley, Southland Region, for a period of three months, during which time 353 red deer were destroyed. In the Blue Mountains Plantation (Canterbury-Otago Region), in which the depredations of fallow deer have been very severe, an official party during a period of three weeks shot approximately four hundred. An official shooting party is at present being organized in the southern portion of the Nelson region. The anticipated result of this experiment is the destruction of a further one thousand deer. The Service has made arrangements in this region to collect deer-hides and to forward them to various exporters in an endeavour to increase the demand overseas.

The sale value of red-deer hides ranges from 4s. to 5s. 3d. each, according to size and the method of fleshing and drying. There is undoubtedly a good market for medium-sized well-dried red-deer hides for utilization in fine leather-work. Certain overseas manufacturers have been favourably impressed with the qualities of these hides, and it is anticipated that values will increase in the near future. An experimental shipment of fallow-deer hides was also made, but so far the results have not been successful as a business proposition. Fresh avenues, however, are now being explored.

There is no doubt that at the present time deer constitute the most serious menace to the State-owned forests, and in consequence of their great numbers the forest-floor has in many places been completely destroyed. In many parts of New Zealand regeneration has disappeared, and the plants which furnish most of the honey and berries upon which native birds subsist have been completely destroyed. Deer-destruction has not yet overtaken the annual increase of the herds; malformation is prominent, and good heads are not obtainable in many districts.

Probably the damage is most apparent in high country, above the bush line. The major alpine plants are obviously a staple diet, and the formation of screes at the headwaters of snow-fed rivers is accelerated and increased in area by the removal of this vegetation. Increased erosion and larger deposits of detritus on low country are the direct result. The true remedy for much of the present high-country erosion, particularly in Canterbury, is afforestation with high-altitude species for protection purposes. This remedy is quite impossible of application in deer-infested country, as the young trees are immediately eaten out.

Notwithstanding the efforts made by some of the acclimatization societies to control this pest, it has reached such proportions and constitutes such a grave danger to the perpetuation of our native flora and fauna that it is now a national problem and should be nationally controlled.

From the purely departmental point of view, it would appear that the Forest Service is carrying the chief financial burden of deer-control, and this expenditure must be reflected in the future cost of timber from exotic plantations.

Control of Fireblight.—Amending regulations for the better control of fire-blight, gazetted on 3rd October, add cotoneaster and medlar to the list of plants the removal of which from any part of the Dominion to another is prohibited.

WEATHER RECORDS: NOVEMBER, 1929.

Dominion Meteorological Office.

GENERAL NOTES.

After a long dry spell, rainy conditions had set in over a large part of the country at the end of October. These continued throughout November, which proved a dull and humid month. Heavy rains were recorded in many districts, some places having the wettest November for many years. The totals for the month were below the normal in the low-lying country facing the Taranaki Bight from Patea to Foxton, in the Wairarapa, and on the Plains country of Canterbury and North Otago. Elsewhere there was an excess that was in most cases considerable. At Auckland, Tairua, Nelson, and Clyde the rain was more than double the average for November, while at Tauranga and Maraehako Station, near Opotiki, it was approximately double.

Temperatures, though there was much warm and humid weather, were, on the average, below normal, especially over the South Island. Sunshine records were also low, while the amount of cloud was correspondingly high.

There was more wind than usual, north-westerlies predominating. In this respect the previous absence of westerlies was to some extent counterbalanced, and a more normal type of spring weather experienced. Most of the rain fell in the north-westerlies, comparatively little being brought by the southerlies, which were rather poorly developed. This fact accounted for the continued dry conditions in some areas.

There were two principal storm periods, the first being from the 4th to the 9th, during which two cyclonic depressions crossed the Dominion, the first over Otago and the second over Auckland. Rain was general, and many heavy falls were recorded in the North Island and western districts. In the central part of the North Island particularly this was a very warm, humid, and rainy spell. On the 6th a sudden thunderstorm and a heavy downpour occurred at Crushington, near Reefton, where some of the creeks were flooded. On the 8th there was a flood in the Wairau River caused by the heavy rain in the back country. On the 9th particularly severe thunderstorms accompanied by exceptionally heavy rains occurred over a large part of the north central portion of the North Island. Flooding was reported from Auckland as far north as Whangarei, in the Lower Thames Valley, and in the Napier district. There were several instances of stock being killed by lightning, and a house near Hastings was struck. In parts of the Coromandel Ranges the rain amounted to a deluge. At the Ohinemuri mines, near Paeroa, a wall of water 14 ft. high came down one of the creeks, and extensive damage was done, one life being lost. Following this, from the 10th to the 12th, occurred one of the finest spells in the month.

In the rear of a westerly depression which passed on the 14th, gales were experienced generally on the 15th and 16th. In Cook Strait they were from the north-west, but elsewhere from the south-west. Snow fell on the ranges on the morning of the 16th, reaching the lower levels at Greymouth, the Bluff, and Nugget Point. A severe frost was experienced in the morning in parts of the South Island, especially North Canterbury, where much damage was done to gardens, fruit, and small crops; Nelson also suffered considerably.

The second of the stormiest periods referred to above was that from the 26th to the end of the month, when a double-centred cyclone crossed the South Island. West or north-west gales occurred from Cook Strait northward, accompanied by heavy rains. In the South Island, also, the rain was general, but only light to moderate in the eastern districts. Again there

were many severe thunderstorms. An interesting feature was another copious deposit of red dust from Australia over a wide area in Taranaki, western Wellington, Nelson, and Marlborough.

RAINFALL FOR NOVEMBER, 1929, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
	North Island.	Inches.		Inches.	Inches.
1	Kaitaia	5·54	15	1·25	3·27
2	Russell	3·91	12	0·90	2·52
3	Whangarei	3·82	11	0·94	3·04
4	Auckland	7·09	19	2·02	3·26
5	Hamilton	6·50	18	1·46	4·04
5A	Rotorua ..	9·77	17	1·31	4·10
6	Kawhia	6·51	19	1·26	4·69
7	New Plymouth	6·15	19	1·37	4·65
8	Riversdale, Inglewood ..	12·60	19	4·20	8·95
9	Whangamomona	10·36	20	1·65	7·29
10	Eltham	6·14	17	1·46	3·35
11	Tairua	9·52	12	2·18	3·96
12	Tauranga	6·57	17	1·17	3·29
13	Maraehako Stn., Raukokore	5·96	18	1·22	3·04
14	Gisborne	2·96	8	0·96	3·02
15	Taupo	4·86	14	0·88	3·43
16	Napier	3·85	8	1·28	2·51
17	Maraekakaho Stn., Hastings	3·55	14	1·25	2·03
18	Taihape	2·92	14	0·82	3·69
19	Masterton	1·06	11	0·22	2·73
20	Patea	3·32	14	0·72	3·91
21	Wanganui	3·12	9	0·75	3·18
22	Foxton	2·12	11	0·50	3·24
23	Wellington (Karori Reservoir)	3·44	14	1·40	3·04
	South Island.				
24	Westport	8·60	18	1·88	7·08
25	Greymouth	14·51	19	2·50	9·13
26	Hokitika	15·43	21	2·04	10·73
27	Ross	20·47	20	3·27	13·94
28	Arthur's Pass	19·16	16	4·12	15·50
29	Okuru, S. Westland ..	13·22	15	2·18	12·96
30	Collingwood	..	..	..	7·68
31	Nelson	6·91	13	2·56	2·93
32	Spring Creek, Blenheim ..	3·77	10	1·60	2·42
33	Tophouse	11·28	20	3·45	6·62
34	Hanmer Springs	2·45	12	0·84	2·93
35	Highfield, Waiau	2·50	7	0·98	2·51
36	Gore Bay ..	1·20	5	0·68	2·05
37	Christchurch	1·06	11	0·24	1·87
38	Timaru	1·00	10	0·30	1·96
39	Lambrook Station, Fairlie ..	1·32	8	0·58	2·01
40	Benmore Station, Clearburn	3·19	14	1·68	2·01
41	Oamaru	1·61	14	0·36	1·93
42	Queenstown	3·56	17	0·55	2·74
43	Clyde	2·96	13	0·58	1·36
44	Dunedin	3·74	17	0·62	3·27
45	Wendon	3·00	15	0·64	2·74
46	Gore	3·23	19	0·65	3·23
47	Invercargill	4·42	22	0·85	4·40
48	Puysegur Point	9·36	23	1·75	8·36
49	Half-moon Bay	4·67	21	0·63	6·15

—*Edward Kidson, Director of Meteorological Services, Wellington, 6/12/29.*

LIVE-STOCK IN NEW ZEALAND, 1929.

Unless otherwise specified, the enumeration is at 31st January.

Land District.	Horses.	Asses and Mules.	Cattle (including Dairy Cows).	Dairy Cows.		Number of Sheep shorn, 1928–29.	Number of Lambs tailed, 1928–29.	Sheep (including Lambs) as at 30th April, 1929.	Pigs.	Goats.	
				In Milk.	Dry.					Angora.	Other.
North Auckland ..	31,999	53	487,196	208,218	16,076	936,739	436,714	1,040,422	88,156	621	2,927
Auckland	44,853	16	788,564	377,607	14,695	1,227,286	730,384	1,291,655	172,766	2,761	4,492
Gisborne	18,557	57	316,720	33,009	3,940	2,979,162	1,299,330	3,146,388	19,262	623	2,456
Hawke's Bay	15,216	1	217,833	46,916	4,702	2,885,404	1,513,886	3,259,059	18,464	2,360	4,722
Taranaki	19,274	1	373,152	199,439	8,207	853,025	428,452	920,791	56,966	21	4,884
Wellington	39,337	35	655,609	185,980	12,911	5,310,566	2,877,518	6,023,381	77,720	802	1,105
Nelson	6,534	3	63,261	25,606	2,136	369,048	161,986	446,066	16,498	715	1,246
Marlborough	6,908	15	43,854	14,750	1,386	1,021,752	459,718	1,124,053	7,712	489	3,488
Westland	2,235	..	41,189	11,591	1,343	64,213	48,217	76,987	6,204	2	262
Canterbury	57,115	44	168,724	70,746	4,605	4,519,775	2,945,478	5,544,167	53,487	191	14
Otago	32,269	5	128,664	49,466	4,621	3,233,528	1,734,898	3,902,845	23,541	4	23
Southland	24,689	7	161,024	67,876	5,237	1,895,062	1,219,377	2,275,568	15,956	1	17
Dominion totals ..	298,986	237	3,445,790	1,291,204	79,859	25,295,560	13,855,958	29,051,382	556,732	8,590	25,636
Totals 1928 (or 1927–28)	307,160	250	3,273,769	1,242,729	109,669	23,958,577	13,178,972	27,133,810	586,898	5,896	18,355

—*Census and Statistics Office.*

ESTIMATES OF THE SEASON'S LAMBING.

FOLLOWING are estimates of the current season's lambing in New Zealand computed from estimated average percentages furnished by Inspectors of Stock. Corresponding figures for the five previous years, together with the actual number of lambs tailed therein, are also given for comparison.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
		NORTH ISLAND.		
1929 ..	8,820,536	87·56	7,723,523	..
1928 ..	8,211,878	84·61	6,948,380	7,286,284
1927 ..	7,905,432	87·28	6,899,861	7,114,057
1926 ..	7,503,200	84·35	6,329,338	6,459,775
1925 ..	7,463,735	85·64	6,391,812	6,345,218
1924 ..	7,148,949	85·00	6,049,654	6,199,881
		SOUTH ISLAND.		
1929 ..	7,887,619	89·87	6,998,691	..
1928 ..	7,322,173	87·74	6,424,887	6,569,674
1927 ..	6,926,298	86·17	5,968,979	6,064,915
1926 ..	6,445,052	84·79	5,465,361	5,609,906
1925 ..	6,251,488	78·61	4,914,046	5,090,562
1924 ..	5,927,145	87·87	5,208,378	5,267,266
		DOMINION.		
1929 ..	16,608,155	88·65	14,722,214	..
1928 ..	15,534,051	86·09	13,373,267	13,855,958
1927 ..	14,831,730	86·76	12,868,840	13,178,972
1926 ..	13,948,252	84·57	11,794,699	12,069,681
1925 ..	13,715,223	82·43	11,305,858	11,435,780
1924 ..	13,076,094	86·14	11,258,032	11,467,147

The following table gives estimates of the current (1929) season's lambing for the several sheep districts :—

Sheep District.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.
Auckland	1,545,849	88·72	1,371,436
Napier-Gisborne	3,815,256	85·42	3,259,127
Wellington - West Coast ..	3,459,431	89·41	3,092,960
Marlborough-Nelson-Westland	777,313	77·2	600,075
Canterbury-Kaikoura ..	3,524,607	92·1	3,246,148
Otago (including Southland)	3,485,699	90·4	3,152,468
Dominion	16,608,155	88·65	14,722,214

—*Live-stock Division.*

REGULATION OF TOBACCO EXPORT.

UNDER an amending measure passed in this year's session of Parliament tobacco is added to the list of products subject to the provisions of the Products Export Act, 1908. The Act provides in effect for compulsory grading and/or certifying and marking, prior to export, of the products covered by it.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

LICK FOR SHEEP AND CATTLE.

R. C. HAMILTON, Mangaweka :—

Would you please tell me if the following recipe should be successful as a lick for sheep and cattle: 80 lb. common salt, 40 lb. calcium phosphate, 20 lb. bicarbonate of potash, 6 lb. sulphate of iron, 4 oz. potassium iodide, 5 lb. gelatine; dissolve gelatine in water with potassium iodide, and then mix in other ingredients; when well mixed pour into moulds to set.

The Live-stock Division :—

The lick specified by you contains too high a proportion of iron and potash. The following should meet the requirements for both cattle and sheep: Sterilized bone-flour, 40 lb.; finely ground limestone, 40 lb.; common salt, 20 lb; sulphate of iron, 2 lb.; potassium iodide, 4 oz. This mixture may be fed in boxes or troughs where the animals have free access. It is not considered necessary to prepare the lick in gelatine moulds, although there is no objection to the use of gelatine as a base.

UTILIZATION OF FOWL-MANURE.

J. WORDSWORTH, Geraldine :—

I have a lot of fowl-manure stored in a shed and not exposed to weather conditions. I heard from an orchardist that he buys fowl-manure and mixes it with superphosphate. Is this advisable, and what proportion of super should one mix?

The Horticulture Division :—

Fowl-manure, which is rich in nitrogen, is best stored under cover and spread in alternate layers with fine soil at a rate of two parts of the former to one of the latter. Before use it should be turned and mixed to bring it to an even friable state. An application of 10 cwt. per acre is an ordinary dressing. The nitrogen is readily available for an organic manure, and it is used largely for top-dressing green crops or stimulating crops on which a heavy setting of flowers or fruit has been made. As a balanced fertilizer for more general purposes the phosphoric acid and potash content may be increased by adding 24 lb. superphosphate and 12 lb. potash salts per hundredweight. These may be either mixed in or applied to the land separately. For 4 acres of fruit or vegetables one hundred birds would supply about all the fertilizers required, together with a little cover-cropping.

PRECAUTIONS AGAINST SHEEP BLOWFLY.

J. B. VOWLES, Te Mata :—

Will you please inform me what to use when sheep are struck with the fly. I have used several things, such as liquid dip, kerosene, &c. These I find are deadly on the maggot, but they will not prevent the fly striking again.

The Live-stock Division :—

The most satisfactory method to prevent the fly striking is to dip with an arsenical dip; liquid dips are of little value. There is no danger in using an arsenical dip if the directions for dipping are thoroughly carried out. If sheep

are dipped off the shears the lasting preventive effect on the fly is less than on those dipped in the wool, and therefore the former should be redipped in two or three months' time. In dipping lambs great care must be taken and the dip made weaker. If the fly strikes sheep which have been thoroughly dipped the maggots will die and cause little or no trouble. A very necessary precaution against blow-fly attack is to ensure that the sheep are clean and properly crutched; also, if possible, the sheep should be kept in open paddocks and away from trees and sheltered positions, as it is in such places that the fly is most prevalent.

FRUITING OF FIG-TREES.

J. B. Vowles, Te Mata :—

I have read an article stating that the fig-tree will not bear fruit unless the wild fig is grown in the same plantation. Will you please inform me where I can secure the wild fig, which by the article is called Capri fig.

The Horticulture Division :—

The statement to the effect that the fig-tree will not bear fruit unless the wild fig is grown in the same plantation is a generalization that is obviously incorrect, as in many parts of the country very good fresh figs are grown and ripened with no Capri figs in the vicinity. The fact is that the Smyrna fig and allied varieties will not crop satisfactorily without two or three varieties of Capri figs and colonies of fig-wasps (*Blastofaga grossorum*) occupying them. A number of Capri fig varieties are required so that figs of a suitable size for the wasp when egg-laying may be available throughout the year. Some of the leading commercial varieties of fresh and dried figs—White Adriatic, for instance—do not require this attention. One or two attempts to introduce the wasp into this country have been made without success, probably due to the fact that a suitable series of Capri fig varieties was not available to maintain the stock. This interesting problem is still receiving attention, but its commercial possibilities are not very promising, as a dry, hot climate is required to produce Smyrna dried figs of good quality.

FORTHCOMING AGRICULTURAL SHOWS.

The following show-dates have been notified by agricultural and pastoral associations :—

Helensville A. and P. Association : Helensville, 29th January.
Opotiki A. and P. Association : Opotiki, 1st February.
Feilding A. and P. Association : Feilding, 4th and 5th February.
Whakatane A. and P. Association : Whakatane, 5th February.
King Country A. and P. Association : Te Kuiti, 6th February.
Rodney Agricultural Society : Warkworth, 8th February.
Te Puke A. and P. Association : Te Puke, 8th February.
Dannevirke A. and P. Association : Dannevirke, 11th and 12th February.
Tauranga A. and P. Association, Tauranga, 11th and 12th February.
Franklin A. and P. Association : Pukekohe, 14th and 15th February.
Masterton A. and P. Association : Solway, 18th and 19th February.
Katikati A. and P. Society : Katikati, 19th February.
Marton A. and P. Association : Marton, 26th February.
Auckland A. and P. Association : Auckland, 27th February to 1st March.
Taranaki Agricultural Society : New Plymouth, 5th and 6th March.
Waikato Central Agricultural Association : Cambridge, 5th and 6th March.
Morrinsville A. and P. Society : Morrinsville, 12th March.
Hawke's Bay A. and P. Society : Autumn Show, Tomoana, 19th March.
Methven A. and P. Association : Methven, 29th March.
Oxford A. and P. Association : Oxford, 3rd April.

FRUIT EXPORT GUARANTEE AND REGULATIONS, 1930.

THE conditions of the Government guarantee for the 1930 season are substantially the same as those for 1929 (published in the *Journal* for November, 1928), only formal or minor amendments having been made.

Amendments to the export regulations consist mainly of additions to the lists of varieties approved for export as follows: Apples—Glengyle Red, Crofton, McLiver's Winesap, Tasma Pride, Grooby's Seedling, Pride of Australia, Desert Gold. Pears—Broom Park, Harrington's Victoria, Giblin's Nelis, Twyford Monarch. General provisions are practically unaltered.

The full conditions and regulations as amended have been printed in pamphlet form.

CROP AREAS AND YIELDS, SEASONS 1927-28 AND 1928-29.

Crop.	1927–28.		1928–29.	
	Area.	Average Yield per Acre.	Area.	Average Yield per Acre.
Wheat—	Acres.		Acres.	
Grain	260,987	36·56 bushels	255,312	34·60 bushels.
Chaff, &c.	1,191	2·00 tons	1,272	1·79 tons.
Oats—				
Grain	88,223	43·66 bushels	73,101	41·93 bushels.
Chaff, &c.	201,437	1·71 tons	194,638	1·71 tons.
Barley—				
Grain	21,091	40·87 bushels	19,500	40·06 bushels.
Chaff, &c.	661	1·83 tons	340	2·27 tons.
Maize—				
Grain	10,291	46·93 bushels	8,986	50·78 bushels.
Ensilage	549	3·23 tons	295	3·59 tons.
Peas	25,128	31·93 bushels	17,893	29·48 bushels.
Beans			170	25·29 bushels.
Linseed	5,213	6·00 cwt.	2,800	8·30 cwt.
Rye-grass seed ..	23,545	444·60 lb.	26,343	428·59 lb.
Cocksfoot seed ..	11,493	173·36 lb.	11,255	182·04 lb.
Chewings fescue seed ..	10,021	267·90 lb.	9,506	286·46 lb.
Crested dogstail seed ..	8,948	236·19 lb.	5,702	223·92 lb.
Red clover and cow-grass seed	7,887	180·00 lb.	9,750	197·60 lb.
White clover seed ..	2,294	165·55 lb.	3,338	169·68 lb.
Other grass and clover seeds	1,493	120·04 lb.	2,123	114·93 lb.
Grass and clover hay ..	250,984	1·76 tons	320,299	1·92 tons.
Lucerne hay	29,257	2·44 tons	30,808	2·62 tons.
Potatoes	21,693	5·59 tons	21,304	5·77 tons.
Green fodder crops ..	216,702	..	219,088	..
Turnips	459,704	..	479,994	..
Mangolds	10,329	..	9,914	..
Onions	703	8·70 tons	880	12·07 tons.
Hops	609	1,246·68 lb.	608	1,274·24 lb.
Tobacco*	690	..	1,000	..

* Outside borough boundaries.

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